

**FAR WESTERN UNIVERSITY**  
**Faculty of Health Sciences**  
**Dadeldhura**



**CURRICULUM**

**Bachelor of Science in Laboratory Medicine**  
**(B.Sc. Lab. Med.)**

# Far Western University

## **Brief History of University**

Far Western University (FWU) is a government-funded institution established through parliamentary legislation in 2010. The university's primary mission is to provide high-quality education in one of the country's most remote regions, with a curriculum tailored to meet national and international contemporary educational needs. FWU has a history of offering programs in various faculties including Humanities and Social Sciences, Education, Management, Science and Technology, Engineering, Agriculture and Law.

Recognizing a significant deficiency in health and medical services in this region, FWU has embarked on establishing a faculty of health sciences. To achieve this mission, a tripartite agreement was reached on January 24, 2022, involving FWU, the Ministry of Health and Population, and the Ministry of Education, Science, and Technology. Dadeldhura Medical College (DMC) has been established as a result of this agreement. Dadeldhura Hospital will serve as the core facility for FWU, responsible for conducting the teaching and learning activities within the faculty of Health Sciences.

The infrastructure for teaching and learning, as well as the curriculum, will be developed in accordance with the standards and guidelines set by the Nepal Medical Council (NMC), the Medical Education Commission (MEC), and the Nepal Health Professional Council to ensure the highest quality of education and training in the field of health sciences.

## **Program Introduction**

Beyond the backdrop of the patient-physician relationship, a multifaceted network operates, and the medical laboratory scientist assumes a pivotal position in aiding physicians in identifying diseases or conditions that can significantly impact patients' lives.

Laboratory medicine functions as the fundamental building block of contemporary scientific medical knowledge and holds a vital role in evidence-based medicine. It contributes to our understanding of illnesses and enhances the medical field's capacity to effectively diagnose and treat various medical ailments.

## **Vision of the Program**

The vision of the B.Sc. Laboratory Medicine program is to be a beacon of excellence and innovation in healthcare. We aim to equip our students with the knowledge and skills to provide precise, ethical, and compassionate laboratory services, ensuring patient safety and well-being. We aspire to advance scientific knowledge, embrace diversity, and foster interdisciplinary collaboration while staying at the forefront of technological advancements. By doing so, we prepare graduates to be leaders in the field, capable of contributing to global health and driving positive change in healthcare systems.

## **Mission of the Program**

The mission of the Laboratory Medicine program is to provide high-quality education and training that prepares students to excel as competent and compassionate medical laboratory scientists. We are committed to advancing scientific knowledge through research and innovation, promoting patient safety and well-being, and fostering a culture of diversity,

inclusivity, and ethical practice. Our mission also involves serving the community through diagnostic services, health education, and outreach initiatives, while preparing graduates to be leaders in the field who contribute to global health and healthcare system improvements.

### **Goal of the Program**

The primary goal of the Laboratory Medicine program is to educate and train highly skilled and ethical medical laboratory scientists/Medical Laboratory Officer, who are well-prepared to meet the rigorous demands of the healthcare field. This includes providing a comprehensive and up-to-date curriculum, fostering a culture of continuous learning and research, and promoting ethical and compassionate patient care. Additionally, the program aims to contribute to the advancement of scientific knowledge, enhance patient safety, and engage with the community to promote health and well-being. Ultimately, the program's goal is to produce graduates who are leaders in their field, capable of making meaningful contributions to healthcare and global health initiatives.

### **Objectives of the Program**

**Educational Excellence:** Provide a rigorous and comprehensive curriculum that equips students with the knowledge and technical skills needed to excel in the field of Laboratory medicine.

**Clinical Competence:** Ensure that graduates are proficient in conducting accurate and reliable laboratory tests, adhering to ethical standards and quality control procedures.

**Critical Thinking:** Foster critical thinking and problem-solving skills, enabling students to analyze complex laboratory data and contribute to evidence-based healthcare.

**Research and Innovation:** Encourage students to engage in scientific research and innovation, contributing to the advancement of medical laboratory science.

**Ethical Practice:** Instill ethical values and professional integrity, emphasizing patient confidentiality and safety.

**Interdisciplinary Collaboration:** Promote effective communication and collaboration with other healthcare professionals to enhance patient care.

**Cultural Competence:** Cultivate an understanding of diverse patient populations and the ability to provide culturally sensitive care.

**Community Engagement:** Engage with the community through health education, outreach, and diagnostic services that contribute to the well-being of individuals and populations.

**Global Health Perspective:** Develop a global perspective on healthcare challenges and solutions, encouraging graduates to participate in global health initiatives.

**Leadership:** Prepare graduates to be leaders in the field, capable of advocating for the profession, shaping healthcare policy, and driving positive change in healthcare systems.

### **Career development**

Attaining a B.Sc. in Laboratory Medicine degree paves the way for numerous career prospects. Professionals in laboratory medicine can find roles across various sectors, encompassing, but not limited to:

1. Hospital laboratories
2. Reference laboratories
3. Educator
4. Forensic laboratories
5. Public health/Infection control
6. Research and product development and promotion
7. Industrial laboratories
8. Molecular biotechnology laboratories

### **Eligibility criteria for admission**

To qualify for admission to the B.Sc. Lab.Med. Program, an applicant must meet one of the following criteria:

- In general candidates must have passed 10+2 or equivalent qualifications from recognized universities/boards with Physics, Chemistry and Biology (PCB) and having passed in each subject securing a minimum of 50% in PCB and also in aggregate or GPA 2.4
- OR, candidates who have passed the Health Science Proficiency Certificate/Diploma with at least 50% aggregate in total marks and registered in respective council could also apply (for more detail, refer to specific programme detail or eligibility criteria published by MEC).
- Selection is based on the merit list of common Entrance Examination conducted by Medical Education commission (MEC).

### **Duration of Course**

The four-year program will be divided into eight semesters and final semester of compulsory clinical laboratory Practicum and Project work.

### **Medium of Teaching and Examination**

The medium of instruction, textbook in all subjects and examination of B.Sc. Lab. Med. Program will be English.

## **COURSE DESCRIPTION**

The primary objective of this course is to provide students with comprehensive training in Laboratory Medicine encompassing both theoretical and practical aspects. It aims to equip students with a broad understanding of various subjects, including Microbiology, Biochemistry, Hematology, Transfusion Medicine, and Histo/Cytology. Additionally, students will gain foundational knowledge in Anatomy, Physiology, Pharmacology, Pathology, Preventive Medicine & First Aid, and Research Methodology, which includes the clinical interpretation of laboratory medicine.

Throughout the course, students will actively engage in laboratory-based disease diagnosis, health assessment, result interpretation, quality control procedures, and the prevention and management of communicable diseases. Their learning journey will involve participating in lectures, seminars, tutorials, and workshops, along with hands-on experience in laboratory experiments. Furthermore, students will be introduced to research methodology, enabling them to embark on both fundamental and practical research endeavors.

### **ACADEMIC ACTIVITIES**

Structured lectures will be arranged to provide an overview of a wide range of subjects, including Anatomy, Physiology, Pharmacology, Pathology, Preventive Medicine & First Aid, Biochemistry, Microbiology, Hematology, Transfusion Medicine & Blood Banking, Histo/Cytology, Biostatistics and Research Methodology, Forensic Medicine, Laboratory Automation, Total Quality Management, Laboratory Medicine, and Clinical Interpretation. These lectures are designed to assist and mentor junior students in their educational and diagnostic laboratory tasks. Furthermore, students will be actively involved in various academic events, conferences, and clinical gatherings.

### **COURSE STRUCTURE**

Course offered in any semester can carry a weightage of 1 to 4 credits. 1 credit is equivalent of 16 contact hours in each semester for Lecture, 32 contact hours in Practical, while 1 credit is equal to 48 contact hours for clinical laboratory practicum/Project work. Academic Activities will be as follows:

Seminars	Every fortnight
Laboratory work	Every day (practical class room/Clinical laboratories)
Lecture	As per lecture scheduled by the department
Conference	Once in a month

## **Training center**

Students will be posted and trained in the Diagnostic Laboratories / Departments of the Hospitals recognized by FarWestern University.

## **Student's evaluation: Formative & Summative assessment**

### **Formative evaluation (Internal assessment)**

Internal evaluation will be done by the responsible faculty under the guidance of program in-charge

### **Theory evaluation**

Internal assessments will be carried out for each subject, with a minimum of one internal evaluation held per semester for each subject. The formative assessment will be administered by the respective faculty members through a variety of methods, including written tests, project assignments, presentations (either individual or group), viva-voce examinations, and assignments.

### **Clinical/Practical evaluation**

The formative clinical assessment of students is overseen by the relevant faculty members. This assessment includes the observation of the students' daily clinical activities and other evaluations performed by the concerned faculty.

### **Summative evaluation (University examination)**

The end-of-semester university examination will be administered by Far-western University. To qualify for participation in the university examination at the end of the semester, students are required to meet the following criteria:

Maintain a minimum attendance rate of 80% for the classes held during the relevant subject's duration, as well as an 80% attendance rate for clinical exposure.

Achieve a minimum score of 50% (equivalent to a C grade) in the internal assessment of theory.

Attain a minimum score of 60% (equivalent to a B grade) in the internal assessment of practical/clinical components.

Meeting these criteria is essential for students to be eligible to take part in the end-of-semester university examination.

### **Conditions and criteria**

In order for a student to successfully complete the subject, they must achieve a minimum score of 50% (equivalent to a C grade) in the theory component and a minimum score of 60% (equivalent to a B grade) in the practical/clinical component, separately, in both the internal and university examinations.

If a student fails in any subject during the university examination, they are required to reappear in the subsequent university examination, following the rules and regulations of Far-western

University.

Students are expected to pass all subjects within eight years from the time of their admission. Failure to do so will result in the student being considered withdrawn from the program, and they will not be permitted to participate in university exams any further.

Re-totaling and re-evaluation of answer papers are conducted in accordance with the university examination rules established by the University.

Disciplinary measures are enforced in accordance with the rules and regulations of the university examination

### **Theory evaluation (Annex I)**

Each theory paper in the university examination is evaluated in the following manner:

Subjective: short answer question (SAQ), applied clinical based question

Objective: multiple-choice questions (MCQ)

### **Practical/Clinical evaluation**

Students are required to diligently maintain their practical logbook and are expected to submit it during the practical university examination.

The practical/clinical evaluation is carried out by two examiners, one internal and one external examiner. These examiners should hold at least the rank of Assistant Professor and are appointed by the University.

Students' assessments are conducted through various methods, including:

- a. Objective Structured Practical Examination (OSPE)
- b. Spotter/case study assessments
- c. Viva examinations

### **Letter grading system**

The grades (marks) awarded to student in a course is based on his/her consolidated performance in final examination. The letter grade in any particular subject is an indication of a student's relative performance in that course. At the end of each semester, student are awarded letter grades which are based on grades and scores obtained in various segment of course evaluation The pattern of grading will be as follows:

<u>Grade</u>	<u>Grade Value</u>	<u>Remarks</u>
A	4.0	Outstanding
A <sup>-</sup>	3.7	Excellent
B <sup>+</sup>	3.3	Very good
B	3.0	Good
B <sup>-</sup>	2.7	Fair
C <sup>+</sup>	2.3	Fair
C	2.0	Fair
C <sup>-</sup>	1.7	Poor
D	1.0	Poor
F	0.0	Fail

### **Grade Point Average**

Each course is converted into the specific number of grade value associated with the grade. Grade Point Average (GPA) is calculated by multiplying the grade value of the earned grade by the number of credits for each course and dividing the total grade points by the total number of semester credits. The GPA must be 2.0 or above at the end of each semester.

### **Cumulative Grade Point Average (CGPA)**

CGPA is calculated at the end of the program. For graduation, a student has to maintain a CGPA at least 2 or above. If a student fails to secure his CGPA, or fails in more than one course in all the examinations (thus securing a permanent F in all the course), then the student has to withdraw from the program.

### **CGPA calculation**

The overall performance is reported by CGPA, which is a weighted average, calculated as follows:

$$CGPA = (c_1g_1+c_2g_2+c_3g_3+.....) / (c_1+c_2+c_3+.....)$$

Where  $c_1, c_2, \dots$  denotes credits associated with the courses and  $g_1, g_2, \dots$  denotes grade value of the grades earned by the students in the respective courses.

The CGPA defines the overall performance category:

CGPA	Performance
3.5-4.0	Distinction
3.0 and below 3.5	First Division
2.0 and below 3.0	Second Division
Less than 2.0	Fail

### **Weightage of Internal and University Examination:**

S.N	Part	Internal Assessment	University Examination	Passing grade
1.	Theory	30 %	70 %	C
2.	Practical	50 %	50 %	B

Students are required to pass both the internal assessment and the university examination independently.

Furthermore, students must successfully complete their research project under the guidance of a research supervisor and attain a minimum grade of 'C' in the evaluation of their research project.



The research topic should be submitted by the conclusion of the seventh semester and must be finalized by the end of the eighth semester. It's important to note that students who fail to submit their research project will not be eligible to receive the degree.

**Degree:**

Successful candidates will be awarded Bachelor of Science in Laboratory Medicine (B.Sc. Lab. Med.)

## CURRICULUM STRUCTURE

### First year Semester I

Subject	Credit Hour
Anatomy I	3
Biochemistry I	3
Microbiology I	2
Pathology I	2
Pharmacology I	2
Physiology I	3
Laboratory I(Anatomy, Biochemistry, Microbiology, Pathology, Pharmacology, Physiology)	3
<b>Total</b>	<b>18</b>

### First year Semester II

Subject	Credit Hour
Anatomy II	2
Biochemistry II	3
Microbiology II	2
Pathology II	2
Pharmacology II	2
Physiology II	3
Laboratory II (Anatomy, Biochemistry, Microbiology, Pathology, Pharmacology, Physiology)	3
<b>Total</b>	<b>17</b>

**Second Year**  
**Semester III**

Subject	Credit Hour
Anatomy III	3
Biochemistry III	2
Microbiology III	2
Pathology III	2
Pharmacology III	2
Physiology III	3
Introduction to Clinical Laboratory	2
Laboratory III (Anatomy, Biochemistry, Microbiology, Pathology, Pharmacology, Physiology)	3
<b>Total</b>	<b>19</b>

**Second Year**  
**Semester IV**

Subject	Credit Hour
Anatomy IV	3
Biochemistry IV	2
Microbiology IV	2
Pathology IV	2
Pharmacology IV	2
Physiology IV	3
Laboratory IV (Anatomy, Biochemistry, Microbiology, Pathology, Pharmacology, Physiology)	3
<b>Total</b>	<b>17</b>

**Third year**  
**Semester V**

Subject	Credit Hour
Clinical Biochemistry I	3
Clinical Microbiology I (Bacteriology, Mycology, &Virology)	3
Hematology I	3
Histology & Cytology I	2
Preventive Medicine & first aid	2
Clinical Biochemistry Laboratory I	1
Clinical Microbiology Laboratory I	1
Hematology Laboratory I	1
Histology & Cytology Laboratory I	1
Clinical Laboratory Practicum (rotational posting)	3
Total	20

**Third year**  
**Semester VI**

Subject	Credit Hour
Clinical Biochemistry II	3
Clinical Microbiology II(Parasitology)	3
Forensic Medicine and Toxicology	2
Hematology II	2
Histology and Cytology II	2
Clinical Biochemistry Laboratory II	1
Clinical Microbiology Laboratory II	1
Hematology Laboratory II	1
Histology and Cytology Laboratory II	1
Clinical Laboratory Practicum (rotational posting)	3
	19

**Fourth Year**  
**Semester VII**

Subject	Credit Hour
Analytical technique and Automation	3
Clinical Microbiology III (Immunology)	2
Human Genetics and Molecular Biology	2
General Medicine	3
Total Laboratory Management	2
Transfusion Medicine and Blood Banking	2
Clinical Microbiology Laboratory III	1
Transfusion Medicine and Blood Banking Laboratory	1
Clinical Laboratory Practicum (rotational posting)	3
Total	19

**Fourth Year**  
**Semester VIII**

Subject	Credit Hour
Biostatistics and Research Methodology	3
ResearchProject Work	3
Clinical Laboratory Practicum (rotational posting)	14
Total	20

Note:

1. The clinical laboratory practicum encompasses rotational clinical postings in various laboratory sections, including Biochemistry, Microbiology, Hematology/Blood Bank, Histology & Cytology.
2. In the eighth semester, students will be assigned a project work. This project must be completed and submitted to the institute prior to the final examination.

**CONTENT OF CURRICULUM**  
**BACHELORE OF SCIENCE IN LABORATORY MEDICINE**

## COURSE CONTENT

### ANATOMY SEMESTER I

#### BASIC CONCEPT

(19 hours)

##### General Anatomy:

(6 hours)

- **Introduction to anatomy:** Anatomical positions, planes and terms.
- **Cartilage:** Classification, sites of occurrence, nutrition and difference between bones and cartilages.
- **Bones:** Classification with examples, parts and blood supply of growing long bone, types of ossification and law of epiphyseal union.
- **Joints:** Classification with examples.
- **Muscles:** Types, classification of skeletal muscle with examples.
- **Nervous Tissue:** Structural and functional classification.
- **Neurons:** Structures and types, nerve fibers, neuroglial cells.

##### General Histology:

(7 hours)

- **Cell and subcellular organelles:** Cell membrane, nucleus, mitochondrion, endoplasmic reticulum, golgi apparatus, lysosome - structure and function (in brief).
- **Epithelial tissues:** Definition, classification with sites of occurrence, functions.
- **Exocrine glands:** Classification with examples.
- **Connective tissues:** Basic types of connective tissue cells, fibers and tissues with sites of occurrence.
- **Sclerous tissue:** Compact and spongy bone, hyaline, elastic and fibrocartilage.
- **Muscles:** Striated, smooth and cardiac muscles.
- **Nervous tissue:** Myelinated nerve fibers, spinal ganglion, sympathetic ganglion.

##### General Embryology:

(6 hours)

- **Gametogenesis:** Spermatogenesis and oogenesis– time of onset, site of occurrence and process.
- **Ovarian cycle:** Mechanism of ovulation, formation and fate of Corpus luteum.
- **Menstrual cycle:** Different phases.
- **Fertilization:** Normal site, steps and effects.
- **Formation of morula and blastocyst.**
- **Implantation of blastocyst:** Normal and abnormal sites, process.
- **Formation of chorion, amnion, yolk sac and bilaminar germ disc.**
- **Formation of primitive streak, notochord and trilaminar germ disc.**
- **Neurulation:** Outline of mechanism.
- **Subdivisions of intraembryonic mesoderm and their derivatives**
- **Foldings of embryo:** Types, cause and effects.
- **Placenta:** Formation, structure, functions.
- **Umbilical cord:** Contents.
- **Twinning:** Types.

- **Teratology:** Basic principles.

**GROWTH - DEVELOPMENT AND GENETICS (5 hours)**

- **Chromosome:** Morphology and classification.
- **Cell division:** Steps of mitosis and meiosis.
- **Chromosomal aberrations:** Morphological and numerical aberrations.
- **Syndromes:** Autosomal (Down's syndrome) and Sex chromosomal (Turner's and Klinefelter's syndrome).
- **Genetic Terms and Symbols.**
- **Patterns of inheritance.**

**AUTONOMIC NERVOUS SYSTEM (2 hours)**

- Introduction to Nervous System.
- **Autonomic nervous systems:** Anatomical organization of sympathetic and parasympathetic nervous system.

**INTEGUMENTARY SYSTEM (2 hours)**

- **Structure of thick and thin skin.**
- **Appendages of skin:** Name of the components.

**MUSCULO-SKELETAL SYSTEM – I (20 hours)**

**Upper Limb (10 hours)**

- **Osteology:** Gross features of clavicle, scapula, humerus, radius and ulna.
- Identification of carpal bones in an articulated hand.
- **Muscles:** Enumeration of pectoral muscles, scapular muscles, deltoid, flexor and extensor groups of muscles of arm and forearm and intrinsic muscles of hand.
- **Brachial plexus:** Formation, parts, branches and applied aspects.
- **Arteries:** Origin and principal branches of axillary, brachial, radial and ulnar arteries.
- **Veins:** Formation, course and termination of basilic, cephalic and median cubital veins.
- **Boundaries, contents, applied aspects of:** Axilla, cubital fossa, anatomical snuffbox and carpal tunnel.
- **Joints:** Types and movements (with muscles involved) of sternoclavicular, acromioclavicular, shoulder, elbow, radio-ulnar and wrist joints.

**Lower Limb (10 hours)**

- **Osteology:** Gross features of hip bone, femur, patella, tibia and fibula.
- Identification of tarsal bones in an articulated foot.
- **Muscles:** Enumeration of muscles of gluteal region, extensor, adductor and flexor compartments of thigh, extensor, peroneal and flexor compartments of leg and layers of sole of foot.



- **Lumbar and sacral plexus:** Formation, branches and applied aspects.
- **Arteries:** Origin and principal branches of femoral, popliteal and tibial arteries.
- **Veins:** Formation, course and termination of long and short saphenous, popliteal and femoral veins.
- **Femoral triangle and popliteal fossa:** Boundaries, contents, applied aspects.
- **Joints:** Types and movements (with muscles involved) of hip, knee, ankle, sub-talar and mid-tarsal joints.

## ANATOMY SEMESTER II

### HAEMOPOIETIC SYSTEM

(4 hours)

- **Gross and microscopic structure of:** Lymph node, thymus, palatine tonsil and spleen.

### RESPIRATORY SYSTEM

(10 hours)

- **Nasal cavity:** Boundaries, gross features of lateral wall of nasal cavity, blood supply, nerve supply, lymphatic drainage, applied anatomy.
- **Nasal septum:** Formation, blood supply, nerve supply, applied anatomy.
- **Paranasal air sinuses:** Names, sites of opening of various air sinuses and functions.
- **Maxillary air sinus:** Boundaries, blood supply, nerve supply, lymphatic drainage, applied anatomy.
- **Larynx:** Skeletal framework, names and actions of intrinsic muscles, parts and features of cavity of larynx, motor and sensory innervations, blood supply, lymphatic drainage and applied anatomy.
- **Trachea:** Extent, gross and microscopic features, important relations, blood supply, nerve supply and applied anatomy.
- **Thoracic cage:**
  - **Osteology:** Gross features of ribs, thoracic vertebrae and sternum.
  - **Inlet and outlet:** Boundaries and structures passing through them.
  - **Typical intercostal space:** Boundaries, contents and applied aspects.
- **Diaphragm:** Attachments, major openings, nerve supply and development.
- **Respiratory movements:** Outline of mechanism of different types of respiratory movements.
- **Bronchial Tree:** Parts of bronchial tree, bronchopulmonary segments and their applied anatomy.
- **Pleura:** Parts, recesses, blood supply, nerve supply, applied anatomy.
- **Lungs:** Gross and histological features, blood supply, nerve supply and lymphatic drainage.
- **Development of respiratory system (in brief).**

### CARDIOVASCULAR SYSTEM

(20 hours)

- **Mediastinum:** Subdivisions (boundaries, contents and applied aspects).
- **Pericardium:** Parts, sinuses, blood supply, nerve supply and applied anatomy.
- **Heart:** External features, internal features of chambers, blood supply, interatrial and interventricular septae (development and anomalies).
- **Blood Vessels:** Ascending aorta, arch of aorta and descending thoracic aorta (extent and branches), superior venacava and azygous vein (formation, termination and major tributaries, microscopic features of elastic and muscular arteries and large sized vein).
- **Thoracic duct:** Formation, termination and areas of drainage.

## ANATOMY

### SEMESTER III

#### GASTROINTESTINAL SYSTEM

(22 hours)

- **Oral cavity:** Subdivisions with boundaries, gross features of lip, cheek, gum.
- **Tooth:** Parts, gross and microscopic features, dentition and dental formulae.
- **Palate:** Parts, muscles of soft palate with their arrangement, nerve supply and actions.
- **Tongue:** Parts, gross and microscopic features, musculature with actions, blood supply, nerve supply, lymphatic drainage, applied aspects and development with anomalies.
- **Salivary glands:** Gross and histological features, blood supply, nerve supply and applied anatomy of parotid, submandibular and sublingual salivary glands.
- **Pharynx:** Parts, gross features, relations, muscles with innervations, development (extent and derivatives of foregut, midgut and hindgut).
- **Oesophagus:** Extent, normal constrictions, gross and microscopic features, blood supply, nerve supply, lymphatic drainage and applied aspects.
- **Anterior abdominal wall:** Regions, layers, rectus sheath (formation and contents).
- **Inguinal canal:** Boundaries, contents and applied aspects.
- **Stomach:** Locations, parts, gross and microscopic features, blood supply, innervations, lymphatic drainage and applied aspects.
- **Small intestine:** Macroscopic and microscopic differences amongst duodenum, jejunum and ileum.
- **Duodenum:** Location, parts, external features, internal features of second part, microscopic features, blood supply, innervations, lymphatic drainage and applied aspects.
- **Large Intestine:** Parts, cardinal features, macroscopic and microscopic differences between large and small intestines.
- **Caecum and Appendix:** Location, gross features, blood supply, innervations, lymphatic drainage and applied aspects.
- **Rectum and anal canal:** Extent, external and internal features, blood supply, lymphatic drainage and applied aspects.
- **Pancreas:** Location, parts, gross and microscopic features.
- **Peritoneum:** Greater and lesser sacs, omenta, mesentery and mesocolon.

#### HEPATOBIILIARY SYSTEM

(8 hours)

- **Liver:** Location, gross and microscopic features, blood supply and applied anatomy.
- **Gall Bladder:** Locations, parts, gross features, blood supply and applied anatomy.
- **Extrahepatic biliary apparatus:** Parts, formation, course with important relations and termination of bile duct.
- **Portal vein:** Formation, tributaries and applied aspect.
- **Portocaval anastomosis:** Sites and contributing vein.

## **RENAL AND ELECTROLYTE SYSTEM**

**(18 hours)**

- **Kidney:** Location, gross and microscopic features, relations, blood supply and applied aspects.
- **Ureter:** Parts, normal constrictions and applied anatomy.
- **Urinary bladder:** Location, external and internal features, nerve supply and applied anatomy.
- **Urethra:** Parts of male urethra.
- **Development:** Brief outline of development of urinary system.

## ANATOMY SEMESTER IV

### ENDOCRINE AND METABOLISM SYSTEM (5 hours)

- **Pituitary gland:** Location, parts, gross and microscopic features, vasculature and development.
- **Thyroid gland:** Location, parts, gross and microscopic features, relations, vasculature, lymphatic drainage, development with anomalies and applied aspect.
- **Parathyroid Glands:** Location, relations, development with anomalies and applied aspect.
- **Adrenal Gland:** Location, gross and microscopic features, vasculature, development and applied aspect.
- **Pancreas:** Microscopic features.

### REPRODUCTIVE SYSTEM (8 hours)

#### Male Reproductive System (3 hours)

- Name of the components of internal reproductive organs and external genitalia, gross and microscopic features of testes, vas deferens, prostate.

#### Female Reproductive System (5 hours)

- Name of the components of internal reproductive organs and external genitalia.
- **Uterus:** Location, parts, gross and microscopic features, supports, blood supply, lymphatic drainage.
- **Ovary:** Gross and microscopic features.
- **Fallopian tube:** Parts.
- **Breast:** Location, structure, blood supply and lymphatic drainage.
- **Bony pelvis:** Differences between male and female pelvis, types of female pelvis.

### CENTRAL NERVOUS SYSTEM AND SPECIAL SENSES (35 hours)

#### Musculo-skeletal system - II

#### Head and Neck (10 hours)

- **Branchial apparatus:** Derivatives.
- **Development and anomalies of face and palate.**

#### Osteology

- **Cranial Bones:** Parietal, Frontal, Occipital, Sphenoid, Temporal, Maxilla, Mandible and Zygomatic bones (Details of gross features, major attachments, blood and nerve supply, ossifications and applied anatomy).
  - Features of norma frontalis, verticalis, lateralis, occipitalis and basalis.
  - Boundaries and features of anterior, middle and posterior cranial fossae.
- **Vertebral Column:** Constituent bones, identifying features (cervical, thoracic and lumbar vertebrae), curvatures, intervertebral disc, joints and attachments of the muscles of the back.
- **Cervical vertebrae:** Identification, details of gross features, major attachments, ossifications and applied anatomy.

- **Scalp:** Layers, blood supply, nerve supply, applied anatomy.
- **Face:** Muscles, motor and sensory innervation, blood supply, lymphatic drainage and applied anatomy.
- **Lacrimal apparatus:** Constituent parts and mode of drainage.
- **Temporal region:** Extent and contents.
- **Infratemporal and Pterygopalatine fossae:** Boundaries and contents (details of maxillary artery and its branches; mandibular nerve and its branches).
- **Parotid region:** Boundaries and contents.
- **Submandibular region:** Boundaries and contents.
- **Tissue spaces around the upper and lower jaws:** Names and applied anatomy.
- **Deep cervical fascia:** Disposition and modifications of its different layers.
- **Cervical group of lymph nodes:** Subgroups, drainage areas, applied aspects.
- **Anterior and posterior triangles of neck:** Subdivisions with their boundaries and contents.
- **Muscles:** Muscles of mastication, supra and infra hyoid group of muscles, sternocleidomastoid and trapezius.
- **Vessels:** Common carotid artery, external carotid artery, internal carotid artery, subclavian artery, external jugular vein and internal jugular vein.
- **Joints:**
  - **Temporomandibular Joint:**  
Type and sub type, constituent bones, capsular attachment, ligaments, movements with muscles involved, blood supply, nerve supply and applied anatomy.
  - **Craniovertebral joints:**  
Atlanto-occipital and Atlanto-axial joints- type, constituent bones, capsular attachment, ligaments, movements with muscles involved, blood supply, nerve supply and applied anatomy.

## Central nervous system

(19 hours)

- **Derivatives of three primitive brain vesicles.**
- **Cerebral hemispheres:** Poles, borders, surfaces, sulci, gyri, lobes, microscopic features of cerebral cortex and functional areas with applied aspect.
- **Nerve fibers of cerebrum:** Types, parts of corpus callosum and internal capsule.
- **Base of brain:** Interpeduncular fossa, circle of Willis and surface attachments of cranial nerves.
- **Diencephalon:** Parts with locations, gross features and major nuclei of hypothalamus and thalamus.
- **Limbic System:** Name of the components.
- **Basal nuclei:** Name of the components.
- **Brainstem:** Mid-brain, pons, medulla including external features and important internal features (positions of cranial nerve nuclei).
- **Cerebellum:** Divisions, gross features and deep cerebellar nuclei.
- **Meninges of brain:** Layers and folds of duramatter.
- **Dural venous sinuses:** Names and positions, location, important relations, communications and applied aspect of cavernous sinus.

- **Spinal cord:** Extent, coverings, external features and cross section at the level of first cervical segment to show the positions of various tracts.
- **Ventricular system:** Names and communications, features in the floor of fourth ventricle.
- **Cranial Nerves:** Enumeration, deep (nuclear) origin, functional components, superficial origin, exit through cranium, extracranial course, branches and applied aspects of V and VII cranial nerves.
- **Blood supply of brain and spinal cord**

### Special senses

(6 hours)

- **Eye:** Tunics, components of refractive media, optic nerve and visual pathway (in brief), extrinsic muscles of eyeball (enumeration, actions, nerve supply and applied anatomy), microscopic structure of retina.
- **Ear:**
  - External ear: Parts and features.
  - Middle ear: Boundaries, contents and applied aspect.
  - Internal ear: Parts.
- **Nose:** Olfactory pathway (outline)
- **Taste buds:** Gustatory pathway (outline)

# PHYSIOLOGY

## SEMESTER I

### BASIC CONCEPT

(24 hours)

- **Introduction to human body:** General functional organization of human body.
- **Body fluid compartments:** Functions of electrolytes, dehydration and over- hydration, terminologies (isotonic, hypotonic, hypertonic fluids), Osmotic pressure (crystalloid and oncotic, osmosis), cell membrane transport, cell to cell and local communication, intracellular mechanism of signal transduction.
- **Homeostasis:** Definition, maintenance, control of internal environment, different regulatory systems in homeostasis, principles of control systems (general characteristics and components of biological control systems, concept of negative and positive feedback correction, error, gain).
- **Hormonal control mechanisms:** Definition of hormones, receptors and target cell, role of hormones in homeostasis.
- **Neural control mechanisms:** Role in homeostasis.
- **Bioelectricity:** Terminology- excitable cells, neurons and muscles and their excitable properties, functional anatomy of neurons, resting membrane potential, Nernst equation.
- **Action potential:** Ionic basis of genesis and propagation, it's refractory period.
- **Receptors:** Classification and functions, cutaneous receptors (classification and function, generator potential, properties and transduction).
- **Body Fluids:** Compartments, constituents of ECF and ICF, measurement of fluid volume in different body compartments - indicator dilution principle, regulation of fluid exchange, clinical abnormalities of fluid volume regulation ( hyponatremia and hypernatremia), safety factors preventing edema.

### GROWTH - DEVELOPMENT AND GENETICS

(6 hours)

- **Physical growth:** Ppubertal growth, skeletal age and physical maturity.
- **Organ growth:** Differential growth of specific organs and tissues i.e. brain, head, lymphoid tissue, visceral, reproductive organs at various ages.
- **Growth spurts in human life:** Infancy, late puberty, growth rates in boys and girls, mental growth and IQ.
- **Factors influencing growth:** Genetic, nutritional, hormonal.
- **Physiology of Aging:** Changes in various systems and mechanisms involved, factors affecting aging. (Should be taught at the end of course)

### AUTONOMIC NERVOUS SYSTEM

(2 hours)

- **Functional organization of nervous system:**
  - Review.
  - Inter neuronal communication - synapse structure, synaptic transmission, neurotransmitters and modulators, site and mechanism of generation of action potential in a neuron.



- Autonomic nervous system- functional organization, division, distribution, transmitters, receptors and higher control.
- Physiological role of ANS in the control of various body functions.
- Definition, anatomical distribution and physiological function, synthesis, storage, release, metabolism and action of neurotransmitters of ANS.

### INTEGUMENTARY SYSTEM

(2 hours)

- **Sweat Glands:** Types, control of secretion, functions.
- **Thermoregulation:**
  - Mechanism, receptors, hypothalamic thermostat.
  - Effects of stimulation of different areas of hypothalamus (heat conservation and heat dissipation).
  - Physiological responses on acute exposure to hot and cold environment.
  - Acclimatization, disorders of thermoregulation (hypothermia, hyperthermia, fever).

### MUSCULO-SKELETAL SYSTEM – I

(14 hours)

- **Functional organization of striated muscles:** Muscle cell, sarcomere and organization of contractile proteins and sarcoplasmic reticulum.
- **Neuromuscular transmission:** Structure, mechanism of transmission, mechanism of generation of end plate potential (EPP) and muscle action potential, myasthenia gravis.
- **Excitation contraction coupling (ECC):** Role of T tubules and SR in release of calcium, cross bridge cycle, mechanism of contraction and relaxation, rigor mortis.
- **Mechanical events during muscle contraction:** Isotonic and isometric contraction, effect of two or more stimuli on muscle contraction- tetanic contraction, preload and afterload, effect of load on velocity of contraction, effect of length on tension developed.
- **Denervated muscle:** Neurotropic factor/s and their role in maintenance of structure and function of striated muscle (fibrillation and paralysis), reinnervation, cross innervations, EMG and strength duration curve, chronaxie and rheobase.
- **Types of muscle fibers:** Structural and functional differences between slow and fast twitch muscle fibers, effect of exercise and training on skeletal muscle structure and function, physiologic basis of fatigue.
- **Physiology of smooth muscle:** Structure, types, mechanism of contraction and relaxation, properties of smooth muscle and effect of neural, hormonal and local factors on it.

## PHYSIOLOGY SEMESTER II

### HAEMOPOIETIC SYSTEM

(8 hours)

**Blood as a body fluid:** Composition, physical characteristics and functions of blood.

- **Plasma:** Normal constituents, plasma proteins (types, concentrations, properties and functions).
- **Red Blood Cells:** Types, distribution, overview of haematopoiesis.
- **Erythrocytes:** Morphology, functions, fate, normal count, PCV, ESR, MCV, MCH, MCHC, fragility, haemolysis.
- **Erythropoiesis:** Definition, stages, regulating factors, RBC indices and clinical usefulness.
- **Anaemia:** Physiological basis of causes and treatment.
- **White Blood Cells:** Classification, morphology, development, normal counts and functions.
- **Platelets:** morphology, functions.
- **Re system.**
- **Blood Groups:** Agglutinogens, agglutinins, Landsteiner's law, ABO group, Rh group.
- **Blood transfusion:** relation to blood groups, indications, hazards, inheritance, erythroblastosis, haemolytic disease of the new born.
- **Hemostasis:** Physiology of coagulation( intrinsic and extrinsic mechanism), clot retraction, fibrinolysis, tests for clotting, natural and other anticoagulants.
- **Blood banking**
  - ABO and Rh system.
  - Blood grouping and cross matching.
  - Blood transfusion reactions.

### RESPIRATORY SYSTEM

(12 hours)

- **Introduction:**
  - Functions of the respiratory system, functional anatomy, inspiratory and expiratory muscles, importance of thoracic diaphragm in respiration, nerve supply to respiratory muscles.
- **Act of breathing:**
  - Mechanics of breathing, changes in thoracic cavity during inspiration and expiration, pleurae, intrapleural pressure changes, pleural fluid, lung compliance, Herring Breuer reflex, J-receptors, pneumothorax, surfactants, airway resistance, work of breathing, Respiratory distress syndrome.
- **Respiratory air:**
  - Composition of atmosphere, alveolar, and expired air, atmosphere pressure, partial pressure of different gases in inspired air, alveolar air, and expired air.
- **Pulmonary volume and capacities:**
  - Tidal, inspiratory, expiratory, and reserve volumes, Functional reserve volume and total lung volume, inspiratory, expiratory, and vital capacities, total vital capacity, forced expiratory volume (FEV1, FEV2), significance of lungs volume and capacities.

- **Pulmonary circulation:**
  - Low pressure circulation, whole cardiac output flows through, no formation of lymph in the lung bed.
- **Alveolar exchange of gases:**
  - Gas laws, diffusion of gases, diffusion membrane, partial pressure gradients, measurement of diffusion capacity using carbon monoxide, ventilation-perfusion ratio, alveolar partial pressure of oxygen, carbon dioxide, nitrogen and water vapors, diffusion of oxygen carbon dioxide, oxygen and carbon dioxide tension in arterial and venous blood.
- **Transport of respiratory gases:**
  - Dissolved O<sub>2</sub> in arterial blood, formation of oxy hemoglobin, O<sub>2</sub> binding capacity in hemoglobin.
  - Total O<sub>2</sub> carrying capacity per 100ml of blood.
  - Delivery of O<sub>2</sub> to tissues, following O<sub>2</sub> tension in tissue level, O<sub>2</sub> dissociation curve and influencing factor, Bohr's effect, tissue production of CO<sub>2</sub>, high partial pressure of CO<sub>2</sub> in tissues diffusion to blood, carries of CO<sub>2</sub> in forms of carbonic acid, bicarbonates, carba amino compounds, role of red blood cells, carbonic anhydrase, chloride shift, Halden effect.
- **Regulation of respiration:**
  - Neural control, pontine and medullary dorsal group of neurons and ventral groups of neuron, inspiratory, expiratory, pneumotaxic and apneustic centers, role of vagus, intercostals and phrenic nerves.
- **Chemical control:**
  - Central chemoreceptors in brain stem, peripheral chemoreceptor in the aortic and carotid bodies, afferent and efferent pathways, effect of high altitude and hypoxia on the central and peripheral receptors, O<sub>2</sub> therapy.
- **Abnormal breathing:** Apnea, hyperapnea, dyapnea, arthropnea.
- **Artificial respiration:** Mouth to mouth, artificial lungs, high pressure respiration in aviation.

## CARDIOVASCULAR SYSTEM

(18 hours)

- **Functional Anatomy of CVS:** Heart chambers, circulation of blood through heart, pulmonary and systemic circulation, introduction to the terms – pressure, flow, resistance, types of blood vessels and their functions.
- **Generation and transmission of cardiac impulse:** S.A. node – location, pacemaker tissue – the site of generation of cardiac impulse.
- **Mechanism of generation of cardiac impulse, the pace-maker potential:** Spread of cardiac impulse to other regions of the heart, excitation of atria, A.V. node, A.V. nodal delay, bundle of His and its branches, excitation of the ventricles, ventricular muscle action potential, nerve supply and its effects, vagal tone, mechanism of heart rate changes.
- **Properties of cardiac muscle:** Arrangement of cardiac muscle fibers, sarcomere, excitation-contraction coupling in cardiac cycle, excitability—contractility, all or none law,

Starling's law of the heart –length-tension relationships, concept of pre-load and after load in the heart, effects of neural and chemical factors in heart contraction.

- **Cardiac cycle:** Systole/diastole, electrical and mechanical changes, correlation of electrical and mechanical changes, heart sounds and murmurs.
- **Electrocardiography:** Principles of ECG, recording of 12 lead ECG, electrical axis, ECG leads, ECG in altered ionic concentrations of the body, myocardial ischemia, and in cardiac arrhythmias.
- **Cardiac output:** Definition, stroke volume, ejection fraction, major determinants, regulation of cardiac output.
- **Heart rate:** Factors affecting—neural and chemical regulation of heart rate, factors affecting heart rate.
- **Haemodynamics:** Determinants of blood flow, blood pressure, resistance, and velocity, Types of flow—laminar and turbulent, factors affecting blood flow and resistance, Poiseuille's regulation law, vascular smooth muscle, relation between pressure, flow and resistance, Local vasodilators and vasoconstrictors, NO and other chemicals.
- **Arterial blood pressure:** Definition, systolic, diastolic, pulse pressure, and mean pressure, regulation of blood pressure (neural regulation), Baroreceptors (location, central connections, brain stem organization).
- **Cardiovascular system centers:** Cardiovascular reflexes, role of sympathetic and parasympathetic nervous system, short term regulation of blood pressure, intermediate and long term regulation – role of hormones ((RAAS, ANP, ADH), local physical factors, and kidney.
- **Microcirculation:** Capillaries – structure, Starling's forces, reabsorption of tissue fluid, formation, circulation, and functions of lymph, edema.
- **Regional circulation:** Special features and regulation of coronary, cerebral, muscle, and skin circulations, Blood brain barrier.
- **Cardiovascular changes during exercise:** Mechanism of increase of heart rate, volume, and cardiac output, redistribution of special blood flow, mechanisms of increased blood supply to the working muscles.
- **Haemorrhagic shock:** Definition of circulatory shock, compensatory mechanisms following hemorrhage, decompensatory mechanisms, irreversible shock.

## PHYSIOLOGY SEMESTER III

### GASTROINTESTINAL SYSTEM

(20 hours)

- **Introduction to GIT:** Functions of GIT, individual parts, enteric nervous system, innervations of gut, regulation of GI functions.
- **Oral cavity:** Salivary secretions, formation, composition, regulation, functions, role in mastication.
- **Physiology of deglutition:** Definition, stages and neural control.
- **Stomach:** Functions, mechanism of gastric secretion, composition of gastric juice, control of secretion.
- **Gastric motility:** characteristics, control, gastric emptying, antral pump mechanism, gastric mucosal barrier, digestion and absorption in stomach.
- **Secretions:** Pancreatic secretions (exocrine) – composition, functions and control.
- **Small intestine:** exocrine and endocrine secretions, functions and regulation, movements and their control.
- **Large intestine:** Movements, functions and control.
- **Gastrointestinal hormones:** Role in secretomotorfunction of GIT.
- **Physiology of vomiting:** Reflex mechanism.
- **Defecation:** Mechanism and control.

### HEPATOBIILIARY SYSTEM

(8 hours)

- Carbohydrate, fat and protein metabolism, synthesis of proteins and clotting factors, formation of urea and bile, storage functions, detoxification of drugs, defense function, endocrine functions in relation to erythropoietin and thrombopoietin.
- **Bile formation, secretion, regulation and enterohepatic circulation.**
- **Gall bladder:** Storage and release of bile, regulation of gall bladder functions.

### RENAL AND ELECTROLYTE SYSTEM

(20 hours)

- **Overview of functions of kidney:**
  - Nephron (Parts and functions).
  - Processes involved in urine formation.
  - Role of kidney in homeostasis.
  - Renal circulation (pressure profile, peculiarities and functional significance).
- **Glomerular filtration:**
  - Structure of glomerulus and filtering membrane.
  - Mechanism of formation of glomerular filtrate.
  - Factors influencing and regulating glomerular filtration rate.
  - Methods of measurement of glomerular filtration rate, its physiological importance and variation.
- **Tubular functions:**

- Mechanism of reabsorption, secretion of electrolytes and other substances in various segments of nephron (proximal convoluted tubule, loop of Henle, distal convoluted tubule, collecting ducts) and its hormonal regulation.
  - Countercurrent mechanism: generation and maintenance of medullary osmotic concentration gradient.
  - Mechanism of formation of acidic and alkaline urine.
  - Water excretion, mechanism of formation of concentrated and dilute urine – diuresis.
- **Micturition:**
    - Definition, nerve supply of urinary bladder and its control.
    - Micturition reflex and its higher neural control.
    - Principle of cystometogram.

## PHYSIOLOGY SEMESTER IV

### ENDOCRINE AND METABOLISM SYSTEM

(10 hours)

- **Introduction to endocrinology:** Definition of hormones, classification, general mechanism of action, concept of second messenger.
- **Hypothalamus:** Hypothalamic hormones and their functions, Hypothalamohypophyseal portal system and its functions.
- **Anterior pituitary:** Names of hormones, Growth hormones (release, function, regulation, secretion and disorders).
- **Posterior pituitary:** Antidiuretic hormone/vasopressin (source, regulation of release, function, clinical importance), Oxytocin (source, regulation of release, function, clinical importance).
- **Thyroid gland:** Physiological effects, regulation of release, features of hypo and hyperactivity of gland.
- **Parathyroid gland:** Role of parathormone and vitamin D in metabolism of calcium and phosphorus, Regulation of secretion of parathyroid gland, Effects of hypo and hyper parathyroidism.
- **Adrenal cortex:**
- **Glucocorticoids:** Names of hormones, physiological effects, regulation of secretion, consequences of hyper and hypo secretion.
- **Minerelocorticoids:** Names of hormones, physiological effects, regulation of secretion, consequences of hyper and hypo secretion.
- **Sex steroids:** Names of hormones, physiological effects, regulation of secretion, consequences of hyper and hypo secretion.
- **Adrenal medulla:** Names of the hormones, physiological actions of epinephrine and norepinephrine, regulation of secretion of adrenal medulla, consequences of hyper secretion of medulla.
- **Stress:** Definition, physiological mechanism for coping up with stress, beneficial and harmful effects of stress.
- **Endocrine pancreas:**
  - Names of hormones.
  - Insulin:** transport, metabolism, regulation of release, physiological effects, features of hypo and hyper secretion.
  - Glucocagon:** secretion, transport, metabolism, regulation of release, physiological effects,
  - Insulin-glucagon molar ratio and implications in alternation.
- **Pineal gland:** Secretion, functions and regulation.
- **Heart and kidney as endocrine organs:** Endocrine secretions, actions, regulation with special reference to Atrial Natriuretic Peptide and renin-angiotensin system.

## REPRODUCTIVE SYSTEM

(8 hours)

- **Introduction**
- **Sexual differentiation, development of sex organs, physiology of puberty.**
- **Male reproductive system:**
  - Functions of primary and accessory sex organs.
  - Spermatogenesis, its regulation, role of Sertoli cells.
  - **Testosterone:** Origin, metabolism, transport, regulation and mechanism of action, dihydrotestosterone, physiological action of testosterone and DHT.
  - **Semen:** Composition and function.
- **Female reproductive system:**
  - **Physiology of menstrual cycle:** Ovarian, uterine, cervical and vaginal changes, role of hormones, ovulation, determination of time of ovulation.
  - **Ovarian hormones:** Estrogen and progesterone- physiological action and mechanism of action.
  - **Control of ovarian function:** Role of pituitary and hypothalamus, feedback control, menopause, abnormalities of menstruation.
  - **Physiology of fertilization and implantation:** Transport of sperms in female genital tract, capacitation, acrosomal reaction, fertilization, transport of fertilized ovum, implantation, fetoplacental unit, functions of placenta.
  - **Physiology of placenta:** Maternal changes during pregnancy, regulation of pregnancy.
  - **Physiology of parturition:** Onset of parturition, factors determining, oxytocin- action and regulation of its secretion.
  - **Physiology of lactation:** Growth and development of breast, the role of different hormones during pregnancy, regulation of onset and maintenance of lactation, secretion, role and regulation of prolactin and oxytocin.
  - **Contraception:** Physiological basis of different methods of contraception- barrier, chemical and hormonal, safe period, IUCD- mechanism of action.

## CENTRAL NERVOUS SYSTEM AND SPECIAL SENSES

(30 hours)

- **Introduction:** Functional anatomy of nervous system, neuron and neuroglial cells, functional unit of nervous system, morphology and types of neurons, classification of nerves.
- **Biophysics of nerve membrane:** Resting membrane potential, ionic basis of resting membrane potential, graded potential, action potential, propagation of action potential.
- **Synapse:** Ultra structure, types of synapses, neuromuscular transmission, synaptic transmitters, synaptic plasticity, site of fatigue.
- **Sensory receptors:** Definition, classification, stimulus, action potential transmission through afferent nerves.



- **Reflexes:** Reflex action, reflex arc, properties of reflex action, clinical significance, stretch reflex.
- **Sensory Nervous system:** Stimulation of receptors, producing of sensory nerve impulse, propagation of sensory impulse through ascending pathways, three neurons for sensation transmission, second neuron crosses to opposite side, central reception of sensation, pain sensation, endogenous relief of pain, referred pain, local and general anaesthesia.
- **Motor System:** Two neuron transmission, descending pathway, pyramidal or corticospinal pathways, extrapyramidal pathways including vestibulospinal motor areas in the cortex.
- **Control of motor function:** Motor cortex, brain stem, primary motor cortex, primary motor areas supplementary motor area, Broca's area, frontal eye field, corticospinal tracts, upper motor neuron, extrapyramidal tract, planning of motor activity.
- **Spinal cord:** Lower motor neuron, effect of motor cortex and red nucleus on spinal motor neuron, somatosensory feedback and control of muscle contraction, role of reticular and vestibular nuclei in control of antigravity muscles, vestibular sensation and equilibrium, semicircular canal and head rotation.
- **Motor functions of the cerebellum:** Functional areas of cerebellum, afferent pathways to the cerebellar pontocerebellar system, output signals from the cerebellum, purkinje cell and deep nuclei, turn on turn off functions, cerebellar control of spinal functions, involvement in planning and sequencing and timing of movements, dysmetria, ataxia, hypotonicity.
- **Basal ganglia:** Controlling patterns of motor activity, putamen circuit, caudate circuit, Parkinsons diseases.
- **Cerebral cortex:** Primary and association areas, dominant hemisphere, higher intellectual functions, language, thoughts, consciousness and memory, short term and long term memory, consolidation of memory, behavior and motivation. The limbic system and the hypothalamus, reward and punishment functions of the limbic system, sleep, brain wave, REM sleep, EEG, epilepsy, Alzheimer's disease.
- **Lesions of different part of central nervous system:** Cortical lesion, internal capsule-hemiplegia, brainstem lesion, basal ganglia, Parkinson disease, chorea, athetosis, ballismus, spinal cord- complete transection- acute effects-spinal shock, recovery; hemisection of spinal cord, syringomyelia, dorsal column.
- **Special Senses**
  - Visual System
  - Auditory System
  - Vestibular System
  - Olfactory System
  - Gustatory System
- **Visual system:** Structure and functions of cornea, aqueous humor formation and functions, intraocular pressure, optics of vision, mechanism of image formation, pupil and its functions, light reflexes and accommodation reflex. Binocular and monocular vision, Error of refraction, visual acuity, field of vision, photoreceptor layers of retina, optic pathways, lesions in optic pathways, color vision, light and dark adaptation, eye movements.
- **Auditory system:** Functions of the ear and properties of sound. Tympanic membrane and middle ear ossicles, mechanism of sound transmission, impedance matching, Internal ear, cochlea, pitch and intensity discrimination, auditory pathways, organization of auditory cortex, deafness types, tests of deafness.

- **Vestibular system:** Labyrinth, vestibular transduction, response to rotational and linear acceleration, vestibular pathways, vestibular ocular reflexes, clinical test for vestibular integrity, disorders.
- **Olfactory system:** Olfactory receptors stimulation pathways, adaptation and disorders.
- **Gustatory system:** Taste buds, receptors stimulation, pathways, types of tastes.

# PATHOLOGY

## SEMESTER I

### COURSE CONTENT

#### BASIC CONCEPT AND AUTONOMIC NERVOUS SYSTEM 32 hours

- **Cellular Adaptations:** Atrophy, hypertrophy, hyperplasia, metaplasia (definitions, examples and mechanism).
- **Cell Injury:**
  - **Reversible and irreversible:** Mechanism and changes produced in different types of degeneration including fatty change in liver and heart.
  - **Necrosis:** Definition, types, examples and morphology.
  - Differences between necrosis and apoptosis.
  - Mechanism of apoptosis.
- **Pathologic classification:** Definition, types, mechanism, examples.
- **Inflammation and Repair:**
  - **Definition, acute and chronic inflammation:** Morphological types, vascular and cellular response, chemical mediators and their role in inflammation
  - **Granuloma:** Definition, description, diseases.
  - **Wound healing:** Mechanisms, factors affecting healing.
- **Shock, Oedema, Thrombosis, Embolism, Infarction and Chronic Venous Congestion:**
  - **Shock:** Definition, morphological changes in target organs and etiopathogenesis.
  - **Oedema:** Pathogenesis.
  - **Thrombosis:** Types, pathogenesis, morphology, fate of thrombus.
  - **Embolism:** Definition, types, sequelae.
  - **Infarction:** Sites, types, consequences.
  - **Chronic venous congestion:** Gross and microscopic changes in lungs, liver, spleen.
- **Neoplasia:**
  - **Definitions of neoplasia:** Tumor- dysplasia, carcinoma in situ and allied definitions.
  - Benign -Malignant neoplasia, differences.
  - Mode of spread of malignant tumors with suitable examples.
  - **Histogenetic classification:** Epithelial, mesenchymal, and totipotent.
  - **Aetiopathogenesis, oncogenesis and clinical presentation of tumors** (benign, malignant).

- **Paraneoplastic syndromes:** Brief discussion.
  - Laboratory diagnosis.
- 
- **Hypersensitivity reaction:** Definition, classification and mechanism

## **PATHOLOGY SEMESTER II**

**32 hour**

### **Blood, reticuloendothelium system and immune system**

**15 hour**

- Anemia
  - Definition, morphological and etiological classification
  - Iron deficiency anemia
  - Megaloblastic anemia
  - Aplastic anemia
  - Thalassemia and sickle cell anemia
- Bleeding disorder
  - Briefly outline on defect in vessel wall, platelet deficiency or dysfunction, derangement of coagulation factors, disseminated intravascular coagulation (DIC), hemophilia and Idiopathic thrombocytopenic purpura (ITP)
- Leukemia:
  - Definition, classification (myeloid and lymphoid)
- Lymphoma
  - Definition, classification (Hodgkin's and Non-Hodgkin), Morphology of Hodgkin lymphoma (mixed cellularity and nodular sclerosis)
- Lymphadenitis: Reactive and Tubercular (Cause and Morphology)

Multiple Myeloma: Clinical features and laboratory diagnosis

### **Cardiovascular system:**

**9 hour**

- Atherosclerosis: Definition, risk factors and complication
- Rheumatic fever and rheumatic heart disease: Etiopathogenesis, clinical features and complication
- Infective endocarditis: Etiopathogenesis, clinical features and complication
- Myocardial infarction: Etiopathogenesis, clinical features and complication
- Hypertension: Definition, etiology, pathogenesis and complication

### **Hepatobiliary system**

**8 hour**

- Cirrhosis of liver: Definition, cause and complication
- Cholecystitis: Etiology and complication (Acute and chronic)
- Cholelithiasis: Risk factors, types of gallstone and complications

**PATHOLOGY**  
**SEMESTER III**

**32 hour**

**Respiratory system**

**10 hour**

- Chronic obstructive pulmonary disease (COPD): definition, etiology and pathogenesis of chronic bronchitis and emphysema, cor-pulmonale
- Bronchial asthma: Definition, types and pathogenesis
- Pneumonia: definition, classification, stage of lobar pneumonia, complication
- Tuberculosis: etiology, types (primary, secondary, progressive)
- Hyaline membrane disease and acute respiratory distress syndrome (ARDS), etiopathogeneiss, clinical features
- Lung cancer: classification, etiopathogenesis
- Pleural effusion: Definition, causes
- Pneumothorax: Definition, types and causes

**Musculoskeletal system**

**8 hour**

- Osteomyelitis: Definition, etiology, clinical features and complication
- Rheumatoid arthritis: Definition, clinical feature and complication
- Gout: Definition, classification and clinical features
- Osteoarthritis: definition and types
- Osteoporosis: Definition and etiology
- Bone Tumors: General classification
- Soft tissue tumors: Classification

**Gastrointestinal system**

**8 hour**

- Gastritis: Definition, cause and types
- Peptic Ulcer: definition, cause, sites and complication
- Carcinoma of stomach: Risk factors, classification (Gross and microscopic)
- Colorectal cancer: Risk factors and types
- Acute and chronic pancreatitis: Etiology, clinical feature and complication

**Urinary system**

**6 hour**

- Acute post streptococcal glomerulonephritis: Etiopathogeneiss, clinical features
- Nephrotic and nephritic syndrome: definition, difference between nephrotic and nephritic syndrome
- Pyelonephritis: definition, types and predisposing conditions
- Renal calculi: Types, cause and complications

## **PATHOLOGY SEMESTER IV**

	<b>32 hour</b>
<b>Metabolism and Endocrine system</b>	<b>11hour</b>
<ul style="list-style-type: none"><li>• Pituitary gland: Hypopituitarism and hyperpituitarism: causes and clinical features.</li><li>• Thyroid gland<ul style="list-style-type: none"><li>○ Hyperthyroidisms: Cause, grave's disease: etiology and clinical features</li><li>○ Hypothyroidism: Cause, cretinism and myxedema: etiology and clinical features</li><li>○ Goiter: Type and clinical features</li><li>○ Tumors: Classification</li></ul></li><li>• Diabetes mellitus: definition, classification, etiopathogeneis, clinical features and complications</li><li>• <b>Parathyroid gland:</b> Hyper and hypoparathyroidism- causes and clinical features</li><li>• <b>Metabolic bone diseases:</b> Rickets and osteomalacia: aetiopathogenesis and clinical features.</li></ul>	
<b>Reproductive system</b>	<b>12 hour</b>
<ul style="list-style-type: none"><li>• Benign prostate hyperplasia (BPH): Etiopathogenesis, gross features and complications</li><li>• Cervical intraepithelial neoplasia: definition</li><li>• Carcinoma of cervix: Risk factors, morphology of squamous cell carcinoma</li><li>• Endometrium<ul style="list-style-type: none"><li>○ Endometriosis: definition., common sites, clinical features, complications</li><li>○ Adenomyosis: definition and clinical features</li></ul></li><li>• Myometrium: Leiomyoma: Gross features, complications\</li><li>• Ovary: Classification of ovarian tumors, risk factors</li><li>• Gestational trophoblastic disease<ul style="list-style-type: none"><li>○ Hydatid form mole: types gross features and clinical course</li><li>○ Choriocarcinoma: Gross features and clinical course</li></ul></li><li>• Breast disorder</li><li>• Breast lump: cause , classification and breast tumors</li><li>• Breast cancer5: risk factos and clinical features</li></ul>	
<b>Nervous system</b>	<b>4 hour</b>
<ul style="list-style-type: none"><li>• Meningitis: etiopathogeneis, cerebrospinal fluid changes invacter4ial, viral and tubercular meningitis</li><li>• Cerebrovascular accident (Stroke): cause and types</li></ul>	
<b>Integumentary system</b>	<b>5 hour</b>

- Skin tumors
- Melanocytic tumors
- Nevus: Clinical features and significance
- Malignant melanoma: risk factors and clinical features
- Non-melanocytic tumors
- Basal cell carcinoma and squamous cell carcinoma: risk factors and clinical features

**Special senses**

**2 hour**

- Trachoma: Etiopathogenesis. Clinical features
- Otitis media: cause, types and complication



## PHARMACOLOGY SEMESTER I

### BASIC CONCEPT

(12 hours)

- **Introduction to pharmacology:** Definition of terminologies related to Pharmacology, dosage forms, sources, nomenclatures, pharmacokinetics and pharmacodynamics.
- **Pharmacokinetics :** Absorption and bioavailability of drugs, factors modifying drug absorption and bioavailability of drugs, difference between bioavailability and bioequivalence and its significance, distribution of drugs, apparent volume of distribution, protein binding of drugs and their clinical significance, passage of drugs through BBB and placental barrier and its importance, Biotransformation, definition, types and factors affecting biotransformation and its clinical significance, Excretion of drugs and factors affecting it, define biological half life and its significance, kinetics of drug elimination, therapeutic drug monitoring and its importance in relation to drugs with low margin of safety.
- **Pharmacodynamics:** Principles of drug-receptor interactions and combined effects of drugs, Dose-response relationship and estimation of ED<sub>50</sub> and LD<sub>50</sub>, therapeutic index, factors affecting the drug response, drug tolerance, drug dependence and addiction and their clinical importance, ADRs and the various methods for monitoring of ADR.

### AUTONOMIC NERVOUS SYSTEM

(12 hours)

- **Cholinergic and adrenergic receptors:** types, drugs acting on them, classification, PK, PD, therapeutic uses, ADR and drug interaction, Cholinergic and adrenergic receptor antagonists, their classification, mechanism of action, pharmacological action, therapeutic uses, ADRs and drug interaction, Principles and use of these drugs in the management of glaucoma, myasthenia gravis, organophosphorus poisoning

### INTEGUMENTARY SYSTEM

(2 hours)

- **Classification, mechanism of actions, pharmacological actions, indications, adverse effects and drug interactions of:**
  - Anti-leprotic drugs.
  - Antifungal drugs.
  - WHO recommended Multidrug therapy of leprosy.
  - Drug treatment for Scabies, psoriasis, acne vulgaris, seborrheic dermatitis.

### MUSCULO-SKELETAL SYSTEM – I

(6 hours)

- **NSAIDs :**Classification, types of analgesics, antipyretics and anti-inflammatory agents, their mechanism of action, indications and adverse effects, Drugs used in acute and chronic gout, RA, osteoarthritis.
- **Skeletal muscle relaxants:** Classification, indications and adverse effects.

## PHARMACOLOGY SEMESTER II

### HAEMOPOIETIC SYSTEM

(12 hours)

- Classification, mechanism of action, pharmacological action, therapeutic usage, adverse effects and drug interaction of:
  - **Haematinics and erythropoietin** : Treatment of iron deficiency, megaloblastic and pernicious anemia.
  - Drugs affecting coagulation, bleeding and thrombosis.
  - Therapy of protozoal infections—malaria, filarial, leishmaniasis.
  - Anticancer drugs.

### RESPIRATORY SYSTEM

(12 hours)

- **Classification, mechanism of action, therapeutic uses and drug interaction of drugs used in:**
  - Bronchial asthma.
  - Drugs in cough: antitussive, expectorant and mucolytics.
  - Anti histamines.
  - Tuberculosis.
  - WHO recommendation antitubercular regimen.
- **Antimicrobials**
- **Classification, pharmacological actions, mechanism of actions, therapeutic uses, adverse effect and contraindications of:**
  - Cell wall synthesis inhibitors.
  - **Beta lactam antibiotics** - Penicillin, cephalosporin and monobactam and carbapenem.
  - **Beta lactamase inhibitors.**
  - **Protein synthesis inhibitors** - Macrolides, aminoglycosides, tetracycline, chloramphenicol.
  - **DNA gyrase inhibitors** – Fluroquinolones, Quinolones.
  - **Folic acid synthesis inhibitors**- Sulfonamides, co-trimoxazole.
  - **Miscellaneous drugs** - Clindamycin, vancomycin, linezolid, spectinomycin, mupirocin, polypeptide antibiotics spectra etc.
  - **P-drug concept.**

### CARDIOVASCULAR SYSTEM

(12 hours)

- **Classification, mechanism of action, pharmacological action, therapeutic usage and effects of:**
  - Drugs used in hypertension.
  - Drugs used in angina and myocardial infarction.
  - Drugs used in congestive heart failure.
  - Drugs used in arrhythmia.
  - Drugs used in hyperlipidemia.

**PHARMACOLOGY  
SEMESTER III**

**GASTROINTESTINAL SYSTEM**

**(12 hours)**

- **Classification, mechanism of action, pharmacological action, therapeutic usage and adverse effects and drug interactions of:**
  - Drugs used in peptic ulcer and H. pylori eradication.
  - Drugs used in vomiting, diarrhea and constipation.
  - Drugs used in helminthiasis.
  - Drugs used in amoebiasis and giardiasis

**HEPATOBIILIARY SYSTEM**

**(4 hours)**

- **Common hepatotoxic drugs: Names.**

**RENAL AND ELECTROLYTE SYSTEM**

**(16 hours)**

- **Diuretics and antidiuretics:** Classification, mechanism of action, pharmacological action, therapeutic usage and adverse effects, drug interactions.
- **Nephrotoxic drugs:** Names.
- **Treatment of urinary tract infection.**

## **PHARMACOLOGY SEMESTER IV**

### **ENDOCRINE AND METABOLISM SYSTEM**

**(14 hours)**

- **Classification, mechanism of actions, pharmacological actions, indications, adverse effects and drug interactions of:**
  - Anterior pituitary hormones and its analogues.
  - Thyroid hormones and its analogues.
  - Antithyroid drugs.
  - Drugs affecting calcium balance.
  - Adrenocorticosteroids and synthetic analogues.
  - Drug therapy of Diabetes Mellitus.

### **REPRODUCTIVE SYSTEM**

**(12 hours)**

- **Classification, mechanism of action, pharmacological action, therapeutic usage adverse effects and drug interaction of**
  - Gonadohormones and antagonist.
  - Hormonal contraceptives.
  - Oxytocics and tocolytics.
  - Anti-viral drugs.
  - Drugs used in pregnancy and lactation.
  - Drugs used in different types of STDs.

### **CENTRAL NERVOUS SYSTEM AND SPECIAL SENSES**

**(22 hours)**

- Effects of alcohol, methyl alcohol poisoning and management.
- Commonly used general anesthetics and preanaesthetic medications.
- **Classification, mechanism of action, pharmacological action, therapeutic usage adverse effects and drug interaction of:**
  - local anaesthetics
  - Anti-epileptic drugs (DOC)
  - Anti- parkinsonian drugs
  - Opioid analgesics and antagonists
  - Sedatives and hypnotics
- Psychopharmacology: Anti-psychotics, antidepressants, antianxiety, and mood stabilizers.
- Effects and management of opioid abuse.
- Therapy of insomnia.

## **BIOCHEMISTRY SEMESTER I**

### **BASIC CONCEPT**

**(24 hours)**

- Basics and common terminology in chemistry
- Units and measurements in chemistry
- Chemistry and medicine (Biochemistry in Medicine)
- **Carbohydrates:** Classification- Aldose and ketose sugars, mono-, di- and polysaccharides, glycosaminoglycans, proteoglycans and glycoproteins
- **Amino acids:** Classification, acid base properties, isoelectric pH, characteristics of a peptide bond.
- **Proteins:** Structural and functional classification.
- **Lipids:** Classification and functions.
- **Cell membranes:** Structure of cell membranes, types of transport proteins.
- **Nucleic acids:** Purines and pyrimidines, ribonucleosides, ribonucleotides.
- **Enzymes:** IUB classification of enzymes, Enzyme kinetics, optimum activity, regulation of enzyme activity, enzyme inhibition, isoenzymes, enzymology in medicine.
- **Metabolism:** Overview of major metabolic pathways of carbohydrate, lipids and protein metabolism, TCA, ETC and oxidative phosphorylation, Pathway of glycolysis, regulation and concept of substrate level phosphorylation.
- **Nucleic acids:** Watson and Crick structure of DNA, genes, genetic code, types of mutations, definition of mutagens.
- **DNA replication:** Semi conservative replication, mechanism of replication.
- **Transcription and translation-** Mechanisms.
- **Regulation of gene expression in eukaryotes.**
- **Purine and pyrimidine metabolism:** Synthesis, degradation, salvage pathway, gout.

### **AUTONOMIC NERVOUS SYSTEM**

**(11 hours)**

- Biochemical basis of myasthenia gravis, organophosphorous poisoning

### **MUSCULO-SKELETAL SYSTEM – I**

**(13 hours)**

- **Muscle Metabolism:** Mechanism of muscle contraction, regulation of [Ca<sup>2+</sup>] in sarcoplasmic reticulum, differences in mechanism in heart and skeletal muscle, creatine phosphate metabolism, function.
- **Energy metabolism:** in well fed, starved and hypoxic states, energy use from resting to contracting state, Cori's cycle, Glucose alanine cycle.
- **Markers of muscle damage.**
- **Constituents of bone:** organic and inorganic, mechanism of bone resorption and deposition.
- **Role of Vitamin D in Calcium homeostasis.**
- **Biochemical mechanism** of osteoporosis, osteomalacia and rickets.

## BIOCHEMISTRY SEMESTER II

### HAEMOPOIETIC SYSTEM

(21 hours)

- **Hemoglobin:** Structure and functions, role of 2,3-BPG, biosynthesis of haem (building materials, rate limiting/regulatory step, key intermediates and termination).
- **Porphyrias:** definitions, types and biochemical basis.
- **Hemoglobinopathies :** definition, genetic basis, abnormal hemoglobin (e.g. HbS): genetic basis and laboratory identification, thalasaemia – molecular basis of -thalasaemia
- **Iron metabolism:** Functions of iron, absorption, transport, storage, elimination, requirement, biochemical indicators and laboratory diagnosis of Iron deficiency anemia.
- **Vitamin B12 and folic acid:** General metabolism of both, role in hemopoiesis and biochemical impairments in deficiency.
- **Glycolysis:** Definition, importance, overview of pathway and regulation, and energetics, glycolysis in RBC and by pathway for generation of 2,3-BPG.
- **HMP shunt pathway:** Importance, overview of pathway, G6PD deficiency and hemolysis, role of glutathione peroxidase in counteracting ROSs generated in RBC, conversion of oxidized glutathione to reduced glutathione by glutathione reductase.
- **Plasma proteins:** Classification and diagnostic importance.

### RESPIRATORY SYSTEM

(20 hours)

- Definition of tissue respiration/biological oxidation.
- Different mechanisms of oxidation-reduction reactions with examples.
- **TCA cycle:**
  - Overview, its regulatory mechanisms, Feeder pathway, and pathways starting from TCA cycle (energetics, amphibolism and clinical applications).
- **Electron transport chain:**
  - Localization of different components in the inner mitochondrial membrane, channeling of reducing equivalents, inhibitors and their sites of action.
- **ATP synthesis (oxidative phosphorylation):**
  - Chemiosmotic theory, mechanism of action of uncouplers, energy metabolism in brown fat.
  - adipose tissues and role of thermogenin as a natural uncoupler, oxidative stress and antioxidant system.
  - Definition of oxidative stress, differences between free radicals and reactive oxygen species.
- **(ROS), list of free radicals and ROSs:**
  - Pathways generating free radicals and ROSs.
  - Damages caused by free radicals reactions.
  - Overview of lipid peroxidation initiated by free radicals.
  - List of the naturally occurring enzymes and non-enzymes antioxidants.

- Role of Antioxidants in protecting tissue damage due to free radical reactions: Clinical implications of the failure of antioxidant system.

- **Vitamin E:** Dietary sources, metabolism, and its antioxidant role.

## **CARDIOVASCULAR SYSTEM**

**(18 hours)**

- **Cholesterol metabolism**
  - Absorption, transport, and synthesis and its regulation.
  - Biochemical basis of action of cholesterol lowering agents.
  - Conditions favoring cholesterol biosynthesis.
  - Hypercholesterolemia and its clinical implications.
  - Synthesis of bile acids, bile salts, and their excretion.
- **Fatty acid and TAG metabolism**
  - Mechanism of conversion of palmitic acid to unsaturated fatty acids.
  - Biochemical basis of nutritionally essential fatty acids.
  - Synthesis of triglycerides for storage in adipose tissues.
  - Synthesis of triglycerides in liver for transportation to peripheral tissues.
  - Beta-oxidation of fatty acids and its energetics.
  - The feed-fast cycle and hormonal intervention in reciprocal regulation of lipogenesis and lipolysis.
- **Metabolism of ketone bodies**
  - Overview of mechanism of synthesis of ketone bodies in liver.
  - Overview of mechanism of degradation/ utilization of ketone bodies in extrahepatic tissues.
  - Conditions favoring of synthesis of ketone bodies (physiological and pathological conditions).
  - Advantages and undesirable aspects of ketonemia.
- **Lipoprotein metabolism**
  - Types, formation, maturation of lipoproteins.
  - Unloading of the lipid fractions to the target tissues.
  - Disorders of lipoprotein metabolism.
- **Lipid Profile**
  - Normal lipid profile.
  - Clinical significance of lipid profile.
- **Metabolism of cardiac muscle**
  - List of the metabolic fuels used by cardiac muscle for its energy source.
  - Metabolic alterations in anoxic conditions.
  - Biochemical aspects of MI.
  - Cardiac markers.

## **BIOCHEMISTRY SEMESTER III**

### **GASTROINTESTINAL SYSTEM**

**(15 hours)**

- **Essential micronutrients:**
  - Vitamins and minerals, their biochemical functions and names and symptoms only of associated deficiency disorders.
  - Protein energy malnutrition.
- **Digestion and Absorption:**
  - Digestive enzymes, secretagogues, mechanisms of secretion of gastric HCl, pancreatic and bile secretions.
  - Dietary carbohydrates, importance of dietary fiber, Digestive enzymes, mechanism of intestinal absorption, lactose intolerance.
  - Protein digestion (enzymes, mechanisms involved in intestinal absorption of amino acids, protein intolerance).
  - Lipids (Digestion and absorption, constituents and role of bile in digestion).
  - Maldigestion and malabsorption.

### **HEPATOBIILIARY SYSTEM**

**(5 hours)??? Need**

**more hours here, minimum 15 hours**

#### **Liver functions:**

- Carbohydrate, fat and protein metabolism.
- Synthesis of proteins and clotting factors.
- Formation of urea and bile, storage functions.
- Detoxification of drugs.
- Defense functions.
- Endocrine functions in relation to erythropoietin and thrombopoietin.
- **Bile formation, secretion, regulation and enterohepatic circulation.**
- **Gall bladder:** storage and release of bile, regulation of gall bladder functions.
- **Carbohydrate metabolism:** Glycogen synthesis and breakdown, regulation, gluconeogenesis (importance, regulation, glucogenic amino acids).
- **Bilirubin metabolism:** synthesis, transport, conjugation and secretion into intestine, disorders associated with bilirubin metabolism, enterohepatic circulation of bile, urobilinogen formation and excretion.
- **Liver function tests:** reference ranges, interpretation.
- **Jaundice:** types, differential diagnosis.
- **Fatty liver:** alcoholic and non-alcoholic.
- **Metabolism of xenobiotics.**
- **Urea cycle and blood urea:** steps of urea cycle and their intracellular localization, urea cycle disorders and ammonia toxicity, blood urea levels, conditions causing altered levels.
- **Mechanism of action of clotting factors, role of vitamin K.**



## RENAL AND ELECTROLYTE SYSTEM

(12 hours)

- **Role of kidneys in acid-base balance:** Bicarbonate reabsorption and H<sup>+</sup> excretion, normal and high anion gap metabolic acidosis with examples, metabolic alkalosis with examples, identification of acid base disorders from arterial blood gas results.
- **Biochemical basis of phenylketonuria, alkaptonuria and homocystinuria.**
- **Sodium and potassium homeostasis:** hyponatraemia, hypernatraemia, hypokalaemia, hyperkalaemia.
- **Renal function tests:** Basis and Interpretation.

## **BIOCHEMISTRY SEMESTER IV**

### **ENDOCRINE AND METABOLISM SYSTEM**

**(18 hours)**

- **Pituitary hormones:** Biochemical properties, biosynthesis, mechanism of actions.
- **Thyroid hormones:** Chemistry, biosynthesis, transport, functions and metabolism, hypothyroidism and hyperthyroidism, thyroid function tests.
- **Parathyroid hormones:** biochemical action, Vitamin D as a hormone.
- **Endocrine pancreas:**
  - **Insulin:** structure, mechanism of secretion and control, cellular mechanism of action in brief, mechanism of action and biochemical effects.
  - **Glucagon:** structure, mechanism of secretion and control, cellular mechanism of action in brief, mechanism of action and biochemical effects.
- **Glucose homeostasis.**

### **REPRODUCTIVE SYSTEM**

**(6 hours)**

- **Sex hormones( Synthesis and Regulation).**
- **Biochemical Test for Infertility.**

### **CENTRAL NERVOUS SYSTEM AND SPECIAL SENSES**

**(8 hours)**

- Neurotransmitters of CNS (dopamine, serotonin, GABA, Glutamate), precursors, synthesis and mechanism of action and associated diseases Parkinson's disease etc
- Cell membrane biochemical components, transportation and impulse propagation mechanism
- Vitamin A. synthesis and visual cycle and deficiency manifestation

## **CLINICAL BIOCHEMISTRY I SEMESTER V**

### **1. Metabolic intermediates and inorganic ions**

**(14 hours)**

Introduction, Non-protein nitrogenous compounds –urea/BUN (Synthesis, clinico-pathological correlations and estimations), Creatin and creatinine (Synthesis, clinico-pathological correlations and estimations), Renal function tests, Clearance tests, Hypertension, CRF, Hemodialysis and osmometry, Uric acid (Synthesis, clinico-pathological correlations and estimations), Arthritis, Ammonia, Amino acids, Prophyrins, Calcium and phosphorous homeostasis, Role of parathyroid hormone, Vitamin D compounds, Calcitonin, Clinico-pathological correlations, Bone disease, Parathyroid diseases, Renal diseases, Estimation of calcium (total and ionized) Phosphorus, cAMP, Other inorganic ions: Magnesium, Iron, Copper, Zinc, Chromium (estimation and clinical significance)

### **2. Water and electrolyte metabolism**

**(4 hours)**

General considerations, Electrolyte balance and homeostasis, Estimation of sodium, potassium, chloride, calcium and phosphate ions, Clinical correlations

### **3. Acid – base balance**

**(6 hours)**

Diffusion of gases in lungs, Action of buffer systems in body, Disturbances in acid-base balance, Arterial blood gas determination and clinical significances, Acidosis, Alkalosis, Spirometry, ABG abnormalities in COPD, Bronchial asthma, Diffuse interstitial pulmonary diseases, Shock, MI, Pulmonary edema and embolism, Exercise, Respiratory distress, Aspirin intoxication, Respiratory failure

### **4. Diagnostic enzymology**

**(9 hours)**

Principles of enzyme activity determinations, Phosphatases- ACP, ALP (Determination and clinical significance), Leucineaminopeptidase (LAP), 5'-nucleotidase,  $\gamma$ -GT, Aminotransferases, Glycolytic enzymes (LD), Citric acid cycle enzymes, Cholinesterase, Ornithine carbamyltransferases (OCT) Iditol dehydrogenases (ID), CK, G-6-PD, Angiotension converting enzyme (ACE), ADA, Enzymes of formed elements of blood: - glutathione peroxidase (GSH-PX); Glutathione synthetase, Other enzymes: amylase, lipases, Enzymes and their clinical significance in body fluids assays

### **5. Liver function tests**

**(6 hours)**

Hepatic tests based on excretory function (hemoglobin degradation, bilirubin metabolism and estimation), Jaundice, Detoxification and drug metabolism, Tests for hepatic synthetic ability (protein, albumin, globulin, A/G ratio, prothrombin time and vitamin K responses), Metabolic

tests, tests related to disordered nitrogen metabolism, Serum enzymes (AST, ALP, ALT,  $\gamma$ -GT), Serum metals and related proteins, Clinical applications of LFT and LFT in non-hepatic diseases

**6. Automation in Clinical Chemistry (5hours)**

History and need of Automation

Types of automation in clinical Biochemistry

Advantages and limitations with automation

**7. Quality Control in Clinical Biochemistry (4 hours)**

**Fundaments of quality**

**Different types of control materials and their utilization**

**Reference Books:**

1. Tietz: *Textbook of Clinical Chemistry* (3<sup>rd</sup> Ed.) 1999, W. B. Saunders.
2. Todd, Sanford, Davidson: *Clinical Diagnosis and Management by Laboratory Method* (17<sup>th</sup> Ed.) 1998, W. B. Saunders.
3. W. J. Marshall and S. K. Bangert: *Clinical Chemistry* (5<sup>th</sup> Ed.) 2004, Mosby Inc.
4. T. M. Devlin: *A Textbook of Biochemistry with Clinical Correlation* (5<sup>th</sup> Ed.) 2002, Dyse-Wiley.
5. L. Kaplan et al.: *Clinical Chemistry Theory, Analysis and Correlations* (4<sup>th</sup> Ed.) 2003, Mosby Inc.
6. H. Varley: *Practical Clinical Biochemistry* (4<sup>th</sup> Ed.), CBS.
7. Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell: *Harper's Biochemistry* (25<sup>th</sup> Ed.) 2000 Appleton and Lange, Stamford.
8. R. A. Harvey and P. C. Champe: *Lippincott's Illustrated Review: Biochemistry* (3<sup>rd</sup> Ed.) 2004, Lippincott Williams and Wilkins.

## **CLINICAL BIOCHEMISTRY II**

### **SEMESTER VI**

#### **1. Gastrointestinal and Pancreatic Function**

**(5 hours)**

Disorders and investigation of gastric function, Pancreatic disorders and their investigation, Acute and chronic pancreatitis,  $\alpha$ -amylase, Lipase, Other pancreatic enzymes (Trypsin, Chymotrypsin and carboxypeptidases), Sweat Test.

#### **2. Cardiac Profile Tests**

**(6 hours)**

The heart, Electric charges in heart, ECG, Ischemic heart disease, Myocardial infarction, Tests for atherosclerosis and risk factor - (FBS, PPBS, BUN, Creatinine, electrolytes), Cardiac risk evaluation tests- (Lipid profile test).

Cardiac injury panel test – CPK and isoenzymes, SGOT, LDH, SHBD, Myoglobin,  $\alpha$ -1-acid glycoprotein, Markers of myocardial infarction- CPK-MB, Myoglobin, Troponin- T and I. CRP. Apolipoproteins.

#### **3. Endocrinology and Hormone Assays**

**(18 hours)**

Pituitary Gland

Anterior pituitary- Growth hormone and Prolactin.

Posterior pituitary- ADH and Oxytocin.

Thyroid Gland- Thyroid disease, Thyroxin, Triiodothyronine, Thyrotropin (TSH), Thyroxin binding globulin, Thyroglobulin.

Adrenal Gland-Pheochromocytoma and catecholamine producing tumors, Epinephrines, VMA, Catecholamines. Cortisol, ACTH, Glucocorticoids, Cushing's syndrome, Addison's disease. Renin, Aldosterone.

Gonadotropins and sex hormones – LH, FSH, Estrogenes, Progesterone, Androgenes. Eicosanoids.

#### **4. Cancer and Tumour Markers**

**(16 hours)**

Introduction, Oncogenes, Mechanism of action of oncogens, Benign and malignant tumors, Characteristics of growing tumor cells.

Enzymes as tumor marker- ALP, CPK, Neuron specific enolase, Alcohol dehydrogenase, Amylase, Esterase, 5'-nucleotidase, Ribonuclease.

Hormones- PSA, Oncofetal antigen, AFP, CEA, Squamous cell carcinoma antigen (SCC), Other Hormones ACTH, ADH, Calcitonin, gastrin, HCG, PTH, Prolactin, GH, human placental lactogen.

Carbohydrate markers- CA-15-3, CA-125,

Blood group antigens- CA-19-9, CA-50, CA-72-4, CA-242.

#### **5. Genetic Disorders and Inborn Error of Metabolism**

**(5 hours)**

Introduction, Autosomal disorders, sex linked disorders, Laboratory diagnosis of Albinism, Alkaptonuria, Maple Syrup Urine disease, histidinemia, cystinuria, Wilson's disease.

## 6. Study and Analysis of Calculi

(5 hours)

Urinary calculi- Mechanism of formation of calculi, Clinical findings. Biochemical analysis.

Gall stones- Factors responsible for formation of stones, clinical findings and chemical analysis.

Pancreatic calculi, salivary calculi, Faecal concretions.

## 7. Therapeutic Drug Monitoring and Clinical Aspects of Toxicology.

(15 hours)

Introduction, Mechanism of absorption, Metabolism and excretion of drugs, Drug assay techniques, Antiepileptic Drugs and methods of determination- (Phenytoin, Phenobarbital, Pyrimidine, Carbamazepin, and ethosuximide) Valporic acid, Digoxin. Bronchodilators and method of determination- Theophylline, Caffeine and dyphylline. Others- Lithium, Cyclosporine, Ethanol, Methanol, Paracetamol, Salicylates, Gentamycin. Drugs of abuse- Barbiturates, Cocaine, Marijuana (Cannabinoid) Amphetamine, Metamphetamine, Phencyclidine, Methadone, Benzodiazepines, Opiates (Morphine).

### Reference Books:

1. Tietz: *Textbook of Clinical Chemistry* (3<sup>rd</sup> Ed.) 1999, W. B. Saunders
2. Todd, Sanford, Davidson: *Clinical Diagnosis and Management by Laboratory Method* (17<sup>th</sup> Ed.) 1998, W. B. Saunders
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6. H. Varley: *Practical Clinical Biochemistry* (4<sup>th</sup> Ed.), CBS
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## MICROBIOLOGY SEMESTER I

### BASIC CONCEPT

(15 hours)

- **Introduction to medical microbiology:**
  - Historical perspectives and contributions of microbiology to medical sciences; Koch's
- Postulates.
  - Differences between Prokaryotic and Eukaryotic Cells.
  - Microscopy (Simple, Compound, Phase contrast, Fluorescent, Electron).
- **Host-pathogen relationship:**
  - Types of host pathogen interactions.
  - Concept of pathogenicity and virulence, microbial virulence factors.
  - Types of infection, sources and routes of infections.
  - Nosocomial infections.
  - Universal safety precautions.
- **Normal flora:** Distributions at different anatomical sites and their role in health and diseases.
- **Bacteriology:**
  - Bacterial structure and their functions ( bacterial cell wall, cell organelles, appendages and
- Spores).
  - Classification of bacteria (on the basis of different staining reactions, morphology and arrangement).
  - Growth and nutrition of bacteria (define generation time, batch culture, continuous culture, growth requirements, types of culture media and bacterial growth curve).
- **Anaerobes and anaerobiosis:** Methods of anaerobiosis, laboratory diagnosis of anaerobic infections.
- **Microbial genetics:** Transformation, transduction and conjugation, their significance in relation to antibiotic resistance, virulence, vaccines and research, list of molecular techniques used in microbiology.
- **Virology:** General properties of viruses, structure and classification of viruses, viral replication, approach to laboratory diagnosis of viral infections.
- **Parasitology:** Classification and general characteristics of medically important parasites, approach to laboratory diagnosis of parasitic infestations.
- **Mycology:** Classification of fungi, types of fungal infections (superficial, subcutaneous, systemic and opportunistic), approach to laboratory diagnosis of fungal infections.
- **Infection control:** Methods of sterilization, disinfection, antisepsis and asepsis, biohazardous waste disposal methods.

### IMMUNE SYSTEM AND IMMUNOLOGY

(10 hours)

- Types of immunity (innate, adaptive, active, passive).

- Cells of immune system and their role in immunity.
- Antigen: definition, epitope, hapten, carrier, determinants and antigen presentation.
- Antibodies: Structure, classes and functions.
- Complement: Definition, pathways of activation and its significance.
- Immune responses. Antigen antibody reactions: Principles, types and applications.
- Hypersensitivity reactions.
- Immunodeficiency disorders.
- Autoimmunity and autoimmune disorders (Grave's disease, Hashimoto's thyroiditis, SLE, Rheumatoid arthritis).
- Immunoprophylaxis: Active and passive, types of vaccines, vaccination schedule.

## **INTEGUMENTARY SYSTEM**

**(5 hours)**

### **Normal flora of the skin**

- **Skin infections:**
  - List infections with causative agents, pathogenesis, clinical features and laboratory diagnosis of *Staphylococcus aureus* and *Streptococcus pyogenes*.
  - Leprosy: Causative agent, pathogenesis, classification, prevention, treatment and laboratory diagnosis
  - Causative agents, clinical features and laboratory diagnosis of fungal infections:
- Superficial Mycoses
- Dermatophytoses
- Subcutaneous Mycoses (Mycetoma and Sporotrichosis)
  - Causative agents, Clinical features and Laboratory diagnosis of viral skin infections
- Measles
- Herpes Simplex
- Varicella zoster
- Poxviruses
- Human papilloma virus
- Molluscum contagiosum
  - Parasitic skin infections
- Larva migrans
- Larva currens
- Scabies
- Pediculosis

## **MUSCULO-SKELETAL SYSTEM – I**

**(2 hours)**

- **Osteomyelitis:** Etiopathogenesis, clinical features and laboratory diagnosis.
- **Infectious arthritis:** Etiopathogenesis, clinical features and laboratory diagnosis.



## MICROBIOLOGY SEMESTER II

### HAEMOPOIETIC SYSTEM

(9 hours)

- **Blood stream infections:**
  - Causes and types of blood stream infection (bacteremia, septicemia, viremia, fungemia).
  - Etiologic agents, pathogenesis, clinical features, laboratory diagnosis, and prevention of :
- Brucellosis
- Leptospirosis
  - Etiology, morphology and life cycle, pathogenesis, clinical features, laboratory diagnosis, and prevention of:
- Malaria
- Leishmaniasis
- Filariasis
- Toxoplasmosis
  - Systemic fungal infections
- *Candida albicans*

### RESPIRATORY SYSTEM

(18 hours)

- Normal flora and pathogens of respiratory tract.
- Morphology, pathogenesis, clinical features, laboratory diagnosis, and prevention of :
  - *Streptococcus pyogenes* and sequelae of streptococcal sore throat
  - *Streptococcus pneumoniae*
  - *Corynebacterium diphtheriae*
  - *Bordetella pertussis*
  - *Mycobacterium tuberculosis* and Atypical Mycobacteria
  - Atypical Pneumonia (Legionella, Chlamydia, Mycoplasma, Ureaplasma)
  - Fungal infections of respiratory tract (*Histoplasma capsulatum*; *Candida albicans*, *Aspergillus fumigatus*, *Cryptococcus neoformans*)
  - Influenza, Parainfluenza, RSV, Rhinovirus, Measles, SARS
  - *Pneumocystis jirovecii*
  - *Paragonimus westermani*

### CARDIOVASCULAR SYSTEM

(5 hours)

- **Etiology, pathogenesis, and laboratory diagnosis of**
  - Infective endocarditis.
  - Acute rheumatic fever and rheumatic heart disease.

## MICROBIOLOGY SEMESTER III

### GASTROINTESTINAL SYSTEM

(24 hours)

- **Normal flora of GIT:** Listing.
- **Gastroenteritis, diarrhoea, and dysentery:**
  - Definitions.
  - Differences between diarrhoea and dysentery.
  - Differences between amoebic dysentery and bacillary dysentery.
- **Common causative agents of diarrhoea:**
  - Names.
  - Mode of transmission, morphology, pathogenesis, clinical features, laboratory diagnosis, and prevention of gastrointestinal infection due to *Escherichia coli* and *Vibrio cholerae*.
- **Common causative agents of dysentery:**
  - Names.
  - Mode of transmission, morphology, pathogenesis, clinical features, laboratory diagnosis, and prevention of infection due to *Shigella* species.
- **Other causative agents of gastroenteritis:**
  - Mode of transmission, morphology, pathogenesis, clinical features, laboratory diagnosis, and prevention of enteric fever (*Salmonella typhi* and *paratyphi*).
  - Morphology, pathogenesis, clinical features, laboratory diagnosis, and prevention of *Helicobacter pylori*.
  - Morphology, pathogenesis, clinical features, laboratory diagnosis, and prevention of *Clostridium difficile*.
- **Protozoan parasites of gastrointestinal tract:**
  - Names.
  - Mode of transmission, morphology, life cycle, pathogenesis, clinical features, laboratory diagnosis, treatment and prevention of *Entamoeba histolytica* and *Giardia lamblia*.
- **Helminthic parasites of gastrointestinal tract:**
  - Mode of transmission, morphology, life cycle, pathogenesis, clinical features, laboratory diagnosis treatment and prevention of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Necator americanus*, *Taenia* species, *Hymenolepis nana*, *Enterobius vermicularis*, *Trichuris trichiura*, *Echinococcus granulosus*.
  - Mode of transmission, morphology, life cycle, pathogenesis, clinical features, laboratory diagnosis, and prevention of opportunistic GI infections (cryptosporidium, cyclospora, isospora, microsporidium, *Balantidium coli*, *Strongyloides stercoralis*).
- **Causative agents of viral diarrhea:**
  - Names.
  - Morphology, pathogenesis, clinical features and laboratory diagnosis of Rotavirus and Norwalk virus.
- **Food poisoning (bacterial and mycotoxins):** definition, causative agents, pathogenesis, clinical features and laboratory diagnosis of bacterial food poisoning.

## HEPATOBIILIARY SYSTEM

(4 hours)

- **Hepatitis Viruses:**
  - Mode of transmission, morphology, pathogenesis, clinical features, laboratory diagnosis, and prevention of Hepatitis virus A, B, C, D, E, and G.
- **Hepatobiliary Parasites:**
  - Common parasites of hepatobiliary system (names).
  - Modes of transmission, morphology, life cycle, pathogenesis, clinical features, laboratory diagnosis, , and prevention of *Fasciola hepatica* and *Echinococcusgranulosus*.

## RENAL AND ELECTROLYTE SYSTEM

(4 hours)

- **Normal flora of urinary tract:** Names
- **Urinary tract infection:** Routes and types, etiologic agents, laboratory diagnosis, interpretive guidelines for urine culture.
- **Renal tuberculosis:** Etiopathogenesis and laboratory diagnosis.
- **Shistosomiasis :**Modes of transmission, morphology, life cycle, pathogenesis, clinical features, laboratory diagnosis and prevention of *Schistosomahaematobium*.

## **MICROBIOLOGY**

### **SEMESTER IV**

#### **REPRODUCTIVE SYSTEM**

**(20 hours)**

- Normal flora of genital tract
- Causative agents, pathogenicity, complications and laboratory diagnosis, treatment and prevention of Sexually transmitted infections (Syphilis, Gonorrhoea, Non- Gonococcal Urethritis, Chancroid, *Granuloma inguinale*, *Lymphogranulomavenereum*, *Herpes genitalia* and genital warts, HPV, HBV, HCV, CMV).
- Causative organism and laboratory diagnosis of genital tract infections: Vaginitis ( Bacterialvaginosis, Trichomonal, Candidal).
- Describe the etiopathogenesis, clinical features, laboratory diagnosis, treatment, and prevention of HIV/AIDS.
- Vertically transmitted infections (Define, describe TORCH).

#### **CENTRAL NERVOUS SYSTEM AND SPECIAL SENSES**

**(12 hour)**

##### **Central nervous system**

- **Meningitis :**
  - Define, classify, list agents of acute and chronic pyogenic meningitis, viral, fungal and parasitic meningitis.
  - Approach to laboratory diagnosis of meningitis, aetiopathogenesis, clinical features, laboratory diagnosis and prevention of CNS infections caused by: (*Neisseria meningitidis*, *S. pneumoniae*, *H. influenzae*, *Listeria monocytogenes*, *Escherichia coli*, *Cryptococcus neoformans*, *Mycobacterium tuberculosis*).
  - Aetiopathogenesis, clinical features, laboratory diagnosis, and prevention of meningitis due to (*Naegleriafowleri* and *Acanthamoebaspp*).
- **Encephalitis/Meningoencephalitis:**
  - Define, and list agents.
  - Approach to laboratory diagnosis of Encephalitis/ Meningoencephalitis.
  - Aetiopathogenesis, clinical features, laboratory diagnosis, and prevention of encephalitis due to: (Japanese encephalitis virus, Dengue virus).
  - Etiopathogenesis, clinical features, laboratory diagnosis, treatment and prevention of: tetanus, botulism, rabies, poliomyelitis.

##### **Special senses**

- **Etiology of Eye infections:**
  - Trachoma: Morphology, life cycle and laboratory diagnosis of *Chlamydia trachomatis*, Keratitis and Conjunctivitis: (list causative agents, laboratory diagnosis).
- **Etiopathogenesis and laboratory diagnosis of :**Otitis externa, Otitis media.

**CLINICAL MICROBIOLOGY I**  
**(Bacteriology, Virology, and Mycology)**  
**SEMESTER V**

- 1. Microscopy** **6 hour**  
Magnification, Numerical aperture, Resolution power and component of microscope. Use of immersion oil and care of microscope and common difficulties. Study of light microscope- dark field, fluorescent, phase-contrast microscope. Electron microscope-TEM and SEM, preparation of smear for electron microscope.
- 2. Staining techniques in microbiology** **10 hour**  
Stain & dye  
significance of staining in bacteriology  
classification of staining.  
Principle, procedures and interpretation of the following staining techniques - Simple staining, Negative staining, Gram's staining, Albert's stain ,Neisser's stain , Ziehl –Neelsen staining , capsule staining, Flagella staining, Spore staining, Fontana stain for spirochetes. Stains for amoeba, fungi, and rickettsiae.
- 3. Antimicrobial drug sensitivity test** **5 hour**  
Requirements, Different methods of sensitivity and interpretation of result.
- 4. Care and management of experimental animals** **4 hour**  
General direction for care, material inoculated, necrosis, common disease and experimental procedure- Rabbits, Mic, Rats, Hamster, Monkey and fowl- their data, cage, feeding, and handling.
- 5. Principle, procedures and interpretation of biochemical tests** **8 hour**  
identification of different bacteria: Catalase , Coagulase , Indole , Methyl Red, Voges-Proskauer , Urease , Citrate , Oxidase, TSIA, Nitrate reduction , Bile solubility, H<sub>2</sub>S production, Demonstration of motility, Hippurate hydrolysis Nagler's reaction, Cholera-red reaction
- 6. Introduction and Principle of instruments:** **10 hour**  
Incubator, hot air oven, laminar air flow, Colony counter, Mac-intos field jar, inoculators etc in microbiology lab. Inoculator, hot plate, distillation plant, centrifuge, Water bath, Magnetic stirrer, water bath, Deionizer etc in microbiology lab
- 4. Pure culture** **2 hour**  
Definition, isolation of pure culture, maintenance and preservation of pure cultures.
- 9. Systematic Bacteriology:** **15 hour**  
staining, culture characteristics, selective culture media, biochemical test, ,mode of infection, incubation, virulence factors pathogenesis, pathology of Infections and laboratory investigation of enterobacteriaceae family: 1. Escherichia coli, 2. Salmonella 3.

Shigella 4. Proteus. 5. Pseudomonas 6. Klebsiella 7. Vibrio 8. Clostridia Mycobacteria 2. Atypical mycobacteria 3. Corynebacteria, Listeria. 4. Anthrax bacillus 5. Brucella 6. Yersenia, Pasteurella & Francisella Streptococcus, 2. Staphylococcus, 3. Pneumococcus, 4. Neisseria, 5. Bordetella & 6. Haemophilus

**10. Parasite interaction in bacterial infection**

**4 hour**

pathogenic properties of bacteria (Colonization of surface, invasion of tissue, production of exotoxin)

**11. Nosocomial infection**

**2 hour**

Introduction, mode of transmission, factors, infection and prevention.

1. J. Chander: *Textbook of Medical Mycology* (2<sup>nd</sup> Ed.) 2002, Mehta Publishers, Delhi.
2. D. Greenwood, R. C.B. Slack and J. F. Peutherer: *Microbiology* (15<sup>th</sup> Ed.) 2000, Churchill Livingstone, London.
2. B. A. Forbes, D. F. Sahn and A. S. Weissfeld: *Bailey & Scott's Diagnostic Microbiology* (11<sup>th</sup> Ed.) 200, Mosby, St. Louis.
3. P.R. Murray, K.S. Rosenthal, G.S. Kobayashi and M.A. Pfaller: *Medical Microbiology* (3<sup>rd</sup> Ed.) 1998, Mosby, St. Louis.
4. Mackie and McCartney: *Practical Medical Microbiology* (14<sup>th</sup> Ed.) 1999, Churchill Livingstone, London.

**CLINICAL MICROBIOLOGY II**  
**(Parasitology)**  
**SEMESTER VI**

- 1. Introduction to Virology** **5 hours**  
History of viral evolution, General properties of viruses, Morphology, Size, Shape, Structure, Chemical properties, Viral haemagglutination, Classification and Replication
  
- 2. Virus Cultivation** **5 hours**  
Animal inoculation, Embryonated egg inoculation and tissue culture, Detection of viral growth in cell culture, Viral assay, Assay of infectivity, Viral genetics
  
- 3. Virus-host Interaction** **5 hours**  
Pathogenesis, Spread of virus in the body, Significance of the incubation period, Host response to virus infection, Immunity in virus infections, Non-immunological responses
  
- 4. Laboratory Diagnosis of Viral Diseases** **12 hours**  
Microscopy, Demonstration of viral antigen, Virus isolation, Serology e.g. ELISA, CFT, Haemagglutination inhibition, Neutralization, Western blotting, Agglutination, Precipitation, RIA, IFA
  
- 5. Viral Vaccines** **2 hour**
  
- 6. Features and classification of parasites of medical importance and parasites associated with HIV** **10 hour**
  
- 7. Procedures for collection and preservation of clinical specimens for laboratory diagnosis and parasitic infections** **2 hours**
  
- 7. Diagnostic methods** **6 hours**  
Principles and methodology used in diagnostics of helminthes, worms, egg counting techniques, concentrations techniques, Casoni test, aldehyde test
  
- 8. Introduction to Mycology** **4 hours**  
Introduction, Classification of medically important fungi, Fungal species associated with AIDS.
  
- 9. Medically Important Fungi** **7 hours**

General characteristics of medically important fungi and their significance to human beings, Opportunistic fungi.

**10. Specimen Preparation**

**2 hours**

Procedures for collection and preservation of clinical specimens for diagnostic purposes.

**11. Antifungal sensitivity test, Antifungal drugs**

**4 hours**

**Reference Books:**

1. D. Greenwood, R. C.B. Slack and J. F. Peutherer: *Microbiology* (15<sup>th</sup> Ed.) 2000, Churchill Livingstone, London.
2. B. A. Forbes, D. F. Sahm and A. S. Weissfeld: *Bailey & Scott's Diagnostic Microbiology* (11<sup>th</sup> Ed.) 200, Mosby, St. Louis.
3. P.R. Murray, K.S. Rosenthal, G.S. Kobayashi and M.A. Pfaller: *Medical Microbiology* (3<sup>rd</sup> Ed.) 1998, Mosby, St. Louis.
4. R. Y. Stanier, J. L. Ingraham, M/ L. Wheelis and P. R. Painter: *General Microbiology* (5<sup>th</sup> Ed.) 1995, Macmillian, Hong Kong.
5. M. C. Timbury: *Notes on Medical Virology*, 1997, Churchill Livingstone, New Delhi.
6. G. J. Tortora, B. R. Funke and C. L. Case: *Microbiology-an Introduction* (8<sup>th</sup> Ed.) 2004, Pearson Education, Patporganj.



**MICROBIOLOGY  
(IMMUNOLOGY)  
SEMESTER VII**

- 1. Introduction to the Immune System** **6 hours**  
Adaptive and innate immunity, Cells of the immune system, Soluble mediators of immunity, Antigens, Immune responses, Defences against extracellular and intracellular pathogens, Vaccination, Immunopathology
- 2. Cells Involved in Immune Responses** **4 hours**  
Lymphoid cells, Mononuclear phagocyte system, Polymorphonuclear granulocytes and platelets
- 3. The Lymphoid System** **4 hours**  
Primary and secondary lymphoid tissue, Primary lymphoid organs, Secondary lymphoid organs and tissues, Lymphocyte traffic
- 4. Antigen Receptor Molecules** **4 hours**  
Immunoglobulins, T-cell antigen receptors, Major histocompatibility complex antigens
- 5. Antigen Recognition** **6 hours**  
Antigen-Antibody binding, The structure of antigens, T-cell-antigen recognition, Antigen processing and presentation, Role of accessory molecules, basic immunological application (Immunofluorescence, RIA, ELISA)
- 6. Cell Cooperation in the Antibody Response** **4 hours**  
Cooperation between different cell types, Cell activation, Antibody responses *in vivo*
- 7. Cell-Mediated Immune Reactions** **6 hours**  
T-cell-independent cell-mediated defense mechanism, T-cell-dependent cell-mediated responses, Cell-mediated cytotoxicity, Lymphokine-mediated activation of macrophages, Granuloma formation, Immunopathology, The cytokine network
- 8. Regulation of the Immune Response** **3 hours**  
Regulation by antigen, Regulation by antibody, Regulation by immune complexes, Regulation by lymphocyte
- 9. Immunological Tolerance** **4 hours**  
T-cell tolerance to self antigens, B-cell tolerance to self antigens, Artificially induced tolerance *in vivo*, Artificially induced tolerance *in vitro*, Potential therapeutic applications of tolerance
- 10. Complement** **4 hours**  
Introduction, Activation of complement, Complement receptors, Biological effects of complement

**Reference Books:**

1. Ivan Roitt, Jonathan Brostoff and David Male (Ed.): *Immunology*, (3<sup>rd</sup> Ed.) 1993, Mosby-Year Book Europe Limited, London.
2. Ivan Roitt: *Essential Immunology*, (8<sup>th</sup> Ed.) 1994, Blackwell Scientific Publication, London

**INTRODUCTION TO LABORATORY MEDICINE  
SEMESTER III**

**COURSE CONTENT**

- |  |        |
|--|--------|
| 1. Introduction to clinical laboratory science             | 4 hour |
| • History of laboratory medicine                           |        |
| • Role of laboratory medicine in health care system        |        |
| • Departments of laboratory medicine and its function      |        |
| • Structure of laboratory service in Nepal                 |        |
| 2. Laboratory safety                                       | 2 hour |
| 3. General Clinical laboratories                           | 2 hour |
| 4. Laboratory Waste management                             | 4 hour |
| 5. Phlebotomy  | 2 hour |
| 6. Preservation and storage of blood and laboratory sample | 2 hour |
| 7. Basic Hematology  | 8 hour |
| • Routine and Special tests in hematology                  |        |
| • Manual count of blood cell and hemoglobin                |        |
| • ESR, Red cell indices and Hematocrit (PCV)               |        |
| • Staining technique                                       |        |
| 8. Basic concept of Immunohematology/ Blood banking        | 4 hour |
| 9. Basic Urinalysis  | 4 hour |
| 10. Basic Serology and Immunology                          | 4 hour |
| 11. Basic Clinical Biochemistry                            | 8 hour |
| • Routine and Special tests in Biochemistry                |        |
| • Renal Function Test                                      |        |
| • Liver Function Test                                      |        |
| • Cardiac Marker   |        |
| 12. Basic Microbiology                                     | 8 hour |
| 13. Basic Quality control for clinical laboratory          | 2 hour |
| 14. Microscope   | 4 hour |
| • History of Microscope                                    |        |
| • Types of Microscope                                      |        |
| • Care and maintenance of microscope                       |        |
| 15. Basic Instrument used in clinical laboratory           | 4 hour |
| 16. Basic Metric system for laboratory                     | 2 hour |

## **HEMATOLOGY I SEMESTER V**

- 1. Hemopoiesis** **8 hours**
  - General aspects of blood cell formation.
  - Sites of hemopoiesis
  - Development of hemopoietic stem cell and blood cell
  - Organization of Hemopoiesis
  - Haemopoietic microenvironment
  - Erythropoiesis, Granulopoiesis, Lymphopoiesis, Thrombopoiesis
  - Morphology of blood cells
  
- 2. Red Blood Cells** **8 hours**
  - Structure and physiology of the Red blood cells
  - Function of Blood cells.
  - Red cell count and Red cell indices.
  - Red cell anomalies
  - Reticulocyte count
  - Synthesis, structure, composition and degradation of hemoglobin
  - Physiological and pathological variation of RBC
  
- 3. White cells** **6 hours**
  - Structure and Physiology of white cells
  - functions of white cells
  - WBC anomalies
  - Physiological and pathological variation of WBC
  
- 4. Platelets** **3 hours**
  - Structure and physiology of platelets
  - Functions of platelets
  - Physiological and pathological variation of platelet
  
- 5. Basic technique in hematology** **8 hours**
  - Technique of blood collection and preservation of blood for hematology
  - Erythrocyte sedimentation rate
  - Packed Cell Volume (PCV) / Hematocrit
  - Staining technique
  - Hemoglobinometry
  
- 6. Hematological Reference Range and Normal Value** **2 hours**
  
- 7. Bone marrow** **5 hours**
  - Normal bone marrow structure.
  - Bone marrow Aspiration and biopsy.

- Processing and Examination of aspirated bone marrow.
- Reporting bone marrow aspirate films

**8. Basic aspects of anemia** **4 hours**

- Definition of anemia, physiological adaptation of anemia
- Clinical features of anemia
- Classification of anemia
- Laboratory approach for diagnosis of anemia

**9. Microcytic Anemia** **4 hours**

- Laboratory approach of microcytic anemia
- Iron metabolism, Iron Deficiency anemia and its Investigation.
- Sideroblastic anemia

**10. Macrocytic Anemia** **4 hours**

- Laboratory approach of macrocytic anemia
- Vitamin B12 and folate metabolism,
- Pernicious anemia
- Megaloblastic anemia and Investigation

**11. Normocytic Anemia:** **8 hours**

- Laboratory Approach of Normocytic Anemia
- Aplastic anemia
- Hereditary and acquired Hemolytic anemia
- Laboratory diagnosis of Hemolytic anemia

**12. Hemoparaiste** **4 hour**

**Reference books:**

1. de Gruchy's: *Clinical Hematology* (5<sup>th</sup> Ed.) 2003, Blackwell Science. Oxford.
2. Dacie and Lewis: *Practical Hematology* (11<sup>th</sup> Ed.) 2001, Churchill Livingstone, London.
3. Hoffbrand: *Post Graduate hematology* (5<sup>th</sup> Edition)
4. Drew Provan: *ABC of Clinical Hematology* 3<sup>rd</sup> edition 2007
5. Richard AMcpherson, Matthew R Pincus: *Henry's Clinical diagnosis and management by laboratory method*: 22<sup>nd</sup> edition

**HEMATOLOGY II  
SEMESTER VI**

- |  |                 |
|--|-----------------|
| <b>1. Different types of blood cells anomalies (Acquired and Hereditary)</b>   | <b>4 hour</b>   |
| <b>2. Principles procedure and interpretation for common laboratory tests</b>  | <b>8 hours</b>  |
| • Plasma Hemoglobin, G6PD, Fetal hemoglobin, Osmotic fragility, Hemoglobin electrophoresis, Sickling test, Methemoglobin, HAM's test |                 |
| <b>3. Thalassemia, hemoglobinopathies and its diagnosis</b>  | <b>4 hours</b>  |
| <b>4. LE cell phenomenon and its demonstration.</b>  | <b>2 hour</b>   |
| <b>5. Coulter counter: Principle, application and interpretation.</b>  | <b>5 hour</b>   |
| <b>6. Leukocyte disorder: Neoplastic and non-neoplastic</b>  | <b>2 hours</b>  |
| <b>7. Leukemia: Definition, Etiology, Clinical features, Classification and laboratory diagnosis.</b>                                | <b>4 hours</b>  |
| <b>8. Chronic Myeloid leukemia</b>   | <b>2 hours</b>  |
| <b>9. Principle, procedure and interpretation of cytochemical stains</b>   | <b>4 hours</b>  |
| • Myeloperoxidase (MPO)  |                 |
| • Sudan Black B (SBB)  |                 |
| • Periodic Acid Schiff (PAS)   |                 |
| • Neutrophil Alkaline Phosphatase (NAP)  |                 |
| • Specific and Non-specific Esterase   |                 |
| • Toluidine Blue   |                 |
| • Cytochemical reaction and leukemia classification  |                 |
| <b>10. Platelet disorders</b>  | <b>6 hour</b>   |
| • Qualitative platelet disorder  |                 |
| • Quantitative Platelet disorder   |                 |
| <b>11. Hemostasis and Thrombosis</b>   | <b>15 hours</b> |
| • Normal hemostasis and blood coagulation  |                 |
| • Coagulation factors  |                 |
| • Fibrinolysis   |                 |
| • Screening test for Bleeding disorder   |                 |
| • Special test for Bleeding disorder   |                 |
| • Coagulation factor assay   |                 |
| • Platelet function test   |                 |

- Acquired and Inherited Bleeding Disorders and its testing
- Acquired and Inherited Thrombotic disorder and its testing

## **12. Flow cytometry**

**4 hour**

- Principle of flow cytometry and instrumentation
- Technique of cell preparation
- Immunological marker for leukemia and lymphoproliferative disorder
- Application of flow cytometry in hematology

## **13. Cytogenetic:**

**4 hours**

- Chromosomal abnormalities
- Cytogenetic disorders
- Karyotyping and Banding technique
- Chromosomal Breakage syndrome
- Application of cytogenetic in hematology

## **14. Molecular Analysis in Hematology**

**5 hours**

- Extraction of DNA and PCR
- Molecular technique and application in malignant and benign disorder

### **References:**

1. F. Firkin, C. Chesterman, D. Penington and B. Rush: *de Gruchy's Clinical Hematology in Medical Practice* (5<sup>th</sup> Ed.) 1989, Oxford University Press, Delhi.
2. S.M. Lewis, B.J. Bain and I. Bates: *Dacie and Lewis Practical Hematology* (9<sup>th</sup> Ed.) 2002, Churchill Livingstone, New Delhi.
3. J.M. Thompson: *Blood Coagulation and Hemostasis* (3<sup>rd</sup> Ed.) 1985, Churchill Livingstone, New Delhi.
4. Sterling T Bennett, Christopher MLehman, Geroge M Rodger: *Laboratory Hemostasis*, 2007.
5. Drew Provan : *ABC of Clinical Hematology* 3<sup>rd</sup> edition 2007
6. A Victor Hoffbrand: *Post Graduate hematology* (6<sup>th</sup> Edition); 2011
7. RicharAMcpherson, Matthew R Pincus: *Henry: Clinical diagnosis and management by laboratory method*: 22<sup>nd</sup> edition

## **HISTOLOGY AND CYTOLOGY I SEMESTER V**

**1. Fixation, fixatives and decalcification** **4 hours**

Definition of fixation, aims of fixation, classification of fixatives, theoretical aspects of fixation, secondary fixation, practical aspects of fixation, decalcification and decalcifying agent

**2. Tissue processing** **4 hours**

Introduction, labeling of tissues, dehydration, clearing, infiltration and embedding, automated tissue processing, manual tissue processing, trouble shooting of tissue processing

**3. Microtomy and section cutting** **8 hours**

Microtomes, types of microtomes, microtome knives, terms used in microtomy, sharpening of microtome knives, routine paraffin section cutting, adhesive mixture for coating slides, floating out bath, difficulties encountered in paraffin section cutting, frozen section

**4. Theory of staining** **10 hours**

Introduction, chemistry of colours in dyestuffs, classification of dyes, storage and maintainance of dyes, staining properties of dyes, staining equipments and materials, methodology of staining, staining in general, mounting stained sections, hematoxylin staining solutions, hematoxylin and eosin methods, staining reactions of carbohydrates, staining of connective tissues, lipids and CNS tissues, microorganisms, demonstration of pigments and minerals

**5. Cytology** **12 hour**

Normal cell structure, functions, cytological criteria of malignancy. Types of , methods of collection & preparation of cell blocks. Staining techniques - principle, preparation and procedure of Papanicolou's stain, May GrunwaldGiemsa stain, Shorr's stain & Aceto orcin stain etc.

**6. Female Genital tract** **4 hour**

Normal cytology. Techniques of collection of specimen for cervical cytology study. Hormonal assessment and cytological techniques. Cervical cytology screening for malignant and pre-malignant conditions. Cytology in Ovarian cancers,

**7. Respiratory tract, Gastro intestinal tract and Urinary tract** **4 hour**

Collection of sample, preparation of smears and staining. Cytology of normal, nonmalignant & malignant conditions.

**8. CSF and Effusions** **4 hour**

Cytology of CSF in inflammatory, nonmalignant & malignant Conditions.

Cytology of effusions in nonmalignant and malignant conditions. Glands – Breast, Thyroid, Salivary glands and Lymph nodes: Cytological features in nonmalignant and malignant conditions of different glands and nipple discharges’

- |   |               |
|---|---------------|
| <b>9. Mounting Media</b>  | <b>2 hour</b> |
| <b>10. Describe briefly the procedure of FNAC and its uses.</b>                         | <b>3 hour</b> |
| <b>11. Electron Microscope</b><br>Principle, steps of tissue preparation and processing | <b>3 hour</b> |
| <b>12. Frozen section and Cryostat</b>  | <b>3 hour</b> |
| <b>13. Museum Technique</b>   | <b>2 hour</b> |



**HISTOLOGY AND CYTOLOGY II**  
**SEMESTER VI**

**1. Special stains: 16 hour**

A) Lipid stain:

- Mention different techniques of lipid stain and the applications of lipid histochemistry in pathology.
- Describe techniques of Oil red O in dextrin, describe standard sudan black B method for fats and phospholipids.

B) Proteins and nucleic acids:

- List the methods for demonstration of nucleic acids.
- Define Feulgen reaction.
- Describe techniques of Nihhydrin-Schiff method for amino-groups and millon reaction for tyrosine.
- Describe techniques of Feulgen nuclear reaction for DNA and Methyl green-pyronin method.

C) Pigments and minerals:

- Describe procedures of perl's Prussian blue reaction.
- Describe procedures of Masson-fontana method for melanin.
- Explain artifact pigments.

D) Amyloid:

- Define amyloid and congo red.
- Describe Highman's congo red technique.

E) Mucin:

- List different types of mucin.
- Describe different techniques of staining mucin and Glycogen (PAS, Alcian blue at different pH)

F) Describe techniques of Trichrome stains and the procedures for demonstration of elastic fibers and muscle striations

G) Decalcification

- Mention different techniques of decalcification and decalcifying agents.
- Explain decalcification process of bones.

H) List different methods for detection and identification of bacteria, fungal element, actinomycetes and viruses.

**2. Semen examination 4 hour**

**3. Enumerate Importance of microphotography and computers in pathology. Explain Telepathology. 2 hour**

4. **Mention cytological findings of sputum and body fluids and cervical smears.Explain sex chromatin.** **3 hour**
5. **Explain importance of cytoscreening.** **2 hour**
6. **Immunocytochemistry and immunohistochemistry.** **12 hour**  
 Principle, procedure, technique  
 Explain the different epithelial, mesothelial, lymphoid, neural and mesenchymal immunohistochemical markers.  
 Mention applications of Microwave technology in histopathology.  
 Describe microwave processing.  
 Describe internal quality control and external quality assessment of immunohistochemistry.Explain the application of quality control in laboratory.
7. **Enzyme histochemistry.** **2 hour**
8. **Mention different Neuropathological techniques and its application.** **2 hour**
9. **Automation in Cytology** **6 hour**  
 Microscopy- light microscope- dark ground & phase contrast, electron microscope, fluorescent microscope. Flow cytometry - Image Analysis & Principles, Equipments, procedures & evaluation.

**HUMAN GENETIC AND MOLECULAR BIOLOGY  
SEMESTER VII**

**COURSE CONTENT**

- 1. Introduction and basic concept of human genetics** **1 hour**
- 2. Fundamental Terminology** **3 hours**  
DNA, RNA, Nucleotides, Nucleosides, tRNA, mRNA, Translation, Transcription, Genes
- 3. Chromosome and cellular reproduction** **3 hour**  
Prokaryotes and eukaryotes chromosome, chromosome structure and cell cycle
- 4. Basic Principle of Heredity** **1 hour**
- 5. RNA and Protein Synthesis** **6 hours**  
Process of DNA transcription, The promoter sequence, Translation of nucleotide sequence into protein sequence, Specific enzyme copulation, Addition of amino acids to the carboxyl terminal end, Degeneration of genetic code, Protein synthesis in ribosome, Release of a protein chain from ribosome, The reading frame for protein synthesis, Protein synthesis in eucaryotes and procaryotes
- 6. DNA Repair Mechanism** **4 hours**  
DNA sequence maintenance, Mutation rate and its importance, Stability of genes and DNA repair, Recognition of DNA damage
- 7. DNA Replication Mechanism** **6 hours**  
DNA replication, Proof reading mechanism, DNA replication in the 5' to 3', DNA primers, DNA helicases, DNA primase, Mismatch proof reading, Replication origins, DNA topoisomerase, DNA replication in eucaryotes and procaryotes
- 8. Genetic Recombination Mechanism** **6 hours**  
Genetic recombination, General recombination, DNA renaturation (hybridization), recA protein, Branch migration, Cross-Strand exchange, Gene conversion, Site-specific genetic recombination
- 9. Virus, Plasmids and Transposable Genetic Elements** **5 hours**  
Viral genomes, RNA virus, DNA virus, Provirus, Retrovirus, Reverse transcriptase, Plasmids
- 10. DNA Cloning and Genetic Engineering** **4 hours**  
Restriction Nucleases, DNA library, Plasmid vectors, Genomic DNA cline, cDNA, Subtractive hybridization, Chromosome walking, Hybrid selection, Expression vectors,

Design of genes, Insertion of engineered genes, Transgenic animal, PCR, Mapping and analysis of large genomes

**11. Use of Genetic Engineering in Pharmaceutical Sciences**

**2 hours**

Production of commercial insulin from E. Coli

**12. Moleuclar Technique**

**5 hour**

DNA and RNA extraxtion, PCR, its type and its application

**Reference Books:**

1. Bruce Albert, Dennis, Bray, Julians Lewis, Martin Raff, Keith Roberts and James D. Watson: Molecular Biology of the Cell (2<sup>nd</sup> Ed.) 1989, Garland Publishing, Inc, New York.
2. James Darnell, Harvey Lodish and David Baltimore: Molecular Cell Biology, (2<sup>nd</sup> Ed.) 1990, Scientific American Books, New York.

# **TRANSFUSION MEDICINE AND BLOOD BANKING**

## **SEMESTER VII**

### **COURSE CONTENT**

- 1. Basic Concepts of Immunohematology** **10 hours**
  - Introduction and history of blood transfusion
  - Immunology of Blood group system
  - Basic Genetic of blood group system
  - Blood group systems
  - Antigen and antibodies of formed element of blood
  - Antigen-antibody reactions (agglutination, sensitization, hemolysis, neutralization, precipitation).
  
- 2. Organsiation of Blood Transuison service (BTS)** **3 hours**
  - Basic guideline for organsiation of BTS
  - Donor recruitment and motivation
  - Organisation of out door camp
  
- 2. Collection, Preservation and Storage of Blood** **10 hours**
  - Management of blood donation
  - Donor selection and preparation
  - Procedure for blood collection,
  - Use of anticoagulant and preservatives
  - Storage of blood and blood components
  - Changes in stored blood component
  
- 3. Blood Components, Separation Techniques and tis uses** **10 hours**
  - Preparation of blood component (Packed RBCs (PRBCs). Platelets concentrate. Fresh frozen plasma (FFP), Irradiated blood component, Washed RBC, Cryoprecipitated)
  - Clinical indication of blood component.
  - Aphaeresis: Plasma apheresis, Leukoapheresis, Platelet apheresis, Thetapeutic apheresis
  
- 4. Pre transfusion testing** **6 hour**
  - Compatibility testing
  - Major and Minor cross match
  - Transfusion Transmitted Infection and its test
  - Screening of blood component and plasma product for transfusion
  
- 4. Blood Bank Procedures** **10 hours**
  - Blood grouping (ABO) and Rh typing
  - Antiglobulin tests (DCT and ICT)
  - Anti-D titration

- Antibody screening tests and its identification

**5. Adverse effect of blood transfusion** **4 hours**

- Classification of transfusion reaction
- Sign and symptoms of transfusion reaction
- Laboratory investigation in transfusion reaction

**Hemolytic disease of Newborn** **2 hour**

- Disease Mechanism and Pathology
- Investigation of Rh and ABO HDN

**6. Bone marrow transplantation** **2 hour**

**7. Automation in blood bank** **4 hour**

- Instrumentation
- Automated blood group and processing
- Automated TTI screening

**8. Quality management in blood bank** **6 hour**

- Development of SOP
- Quality control and quality assurance
- Hospital transfusion committee, Development of form, label and records

**Reference Books:**

1. Quinly E. D. (ed): *Immunohematology ,Principle and Practice*, 2<sup>nd</sup> Ed., Lippincott, Philadelphia, 1998.
2. S.M. Lewis, B.J. Bain and I. Bates: *Dacie and Lewis Practical Hematology* (9<sup>th</sup> Ed.) 2002, Churchill Livingstone, New Delhi.
3. R.K Saran: *Transfusion Medicine Technical Manual*; : 2<sup>nds</sup> Edition 2003

**FORENSIC MEDICINE AND TOXICOLOGY**  
**SEMESTER VI**

**COURSE CONTENT**

- 1. Introduction** **2 hour**
  - Define and give history of forensic medicine.
  
- 2. Legal procedures in medico-legal cases:** **4 hour**
  - Explain inquest, witness, medical evidence, attendance by medical personnel in court as witness.
  
- 3. Legal and ethical aspects of laboratory practices:** **6hour**
  - Explain codes of ethics, acts in connection with medical laboratory profession, professional misconduct and negligence
  - Mention the duties of a registered laboratory practitioner, consent, and maintenance of laboratory record.
  - Mention salient features of Nepal Health Professional Council Act
  - Duties of registered laboratory practitioner
  - Obtaining informed and written consent
  
- 4. Laboratory methods of identification of an individual:** **6 hour**
  - Explain process of determination of sex, estimation of age (infants) including use of DNA (PCR),
  - Describe the process of medico-legal aspects of examination of blood, seminal fluid, saliva, vaginal fluid and hairs.
  - Vaginal swab specimen processing methods and identification of spermatozoa on sexual assault swabs
  - Collection and Preservation of Blood Evidence from Crime Scenes, Identification, blood typing, Origin and Categorization of Blood
  - Describe the process of forensic aspects of examination Hbs
  - Characterization of unknown stains
  - Blood spatter analysis for crime reconstruction
  - Paternity testing
  - DNA typing for identification of victims and suspects
  
- 5. Forensic Science Laboratory** **5 hour**
  - Set up a forensic science lab.
  - Chromatography, electrophoresis, spectrophotometry and microscopies in forensic medicine
  
- 6. Forensic toxicology** **5 hour**
  - Define medico-legal autopsies
  - Preserve visceral organs and blood

- Explain the different laboratory tests for qualitative and quantitative analysis of poison
- List common poisons in Nepal

**7. Drug dependence and drug abuse:**

**4 hour**

- List common drugs of drug abuse
- Mention different samples related with case of drug abuse
- Color reactions for some common drugs abuse

**Reference Books:**

1. Text book of Forensic medicine and Toxicology 2<sup>nd</sup> edition by N.G. Rao
2. Forensic Medicine and toxicology 14<sup>th</sup> edition by V.V. Pillay
3. ApurvaNandy: Principles of Forensic Medicine



## **BANALYTICAL TECHNIQUES AND AUTOMATION SEMESTER VII**

**1. Optical Techniques** (Colorimeter, spectrophotometer, Reflectance photometer, Flame emission spectrophotometer, Automatic absorption spectrophotometer, Fluorometry, Chemiluminescence, Bioluminescence and Electroluminescence, Nephelometry, etc)

**6 hour**

- 1.1 Basic concept and instrumentation
- 1.2 Operating Principal
- 1.3 Advantages and limitations
- 1.4 Basic components and their function
- 1.5 Handling and application
- 1.6 General maintenance and repair

**2. Electrochemistry and Chemical Sensors** (Potentiometry and Ion selective electrode, Amperometry, Conductometry, Coulometry, Optical chemical sensor and biosensor etc)

**4 hour**

- 2.1 Basic concept and instrumentation
- 2.2 Operating Principal
- 2.3 Advantages and limitations
- 2.4 Basic components and their function
- 2.5 Handling and application
- 2.6 General maintenance and repair

**3. Electrophoresis**

**2 hour**

- 3.1 Basic concept and types
- 3.2 Operating Principal
- 3.3 Advantages and limitations
- 3.4 Basic components and their function
- 3.5 Handling and application
- 3.6 General maintenance and repair

**4. Chromatography**

**2 hour**

- 4.1 Basic concept and types
- 4.2 Operating Principal
- 4.3 Advantages and limitations
- 4.4 Basic components and their function
- 4.5 Handling and application
- 4.6 General maintenance and repair

**5. Mass Spectrometry**

**2 hour**

- 5.1 Basic concept and types
- 5.2 Operating Principal
- 5.3 Advantages and limitations
- 5.4 Basic components and their function
- 5.5 Handling and application

5.6 General maintenance and repair

**6. Integration of Automation** **3 hour**

- 6.1 Overview, history and types of automation
- 6.2 Understand works station and work volume
- 6.3 Automated Specimen Transport
- 6.4 Automated Specimen Processing
- 6.5 Evaluation of Requirements
- 6.6 Problems of Integration

**7. Flow Cytometers** **3 hour**

- 7.1 Basic concept and types
- 7.2 Operating Principal
- 7.3 Advantages and limitations
- 7.4 Basic components and their function
- 7.5 Handling and application
- 7.6 General maintenance and repair

**8. Hematology Cell counters** **3 hour**

- 8.1 Basic concept and types
- 8.2 Operating Principal
- 8.3 Advantages and limitations
- 8.4 Basic components and their function
- 8.5 Handling and application
- 8.6 General maintenance and repair

**9. Urine Analyzers** **3 hour**

- 9.1 Basic concept and types
- 9.2 Operating Principal
- 9.3 Advantages and limitations
- 9.4 Basic components and their function
- 9.5 Handling and application
- 9.6 General maintenance and repair

**10. Nucleic Acid Analyzers** **3 hour**

- 10.1 Basic concept
- 10.2 Operating Principal
- 10.3 Advantages and limitations
- 10.4 Basic components and their function
- 10.5 Handling and application
- 10.6 General maintenance and repair

**11. Micro Plates Systems** **2 hour**

- 11.1 Basic concept
- 11.2 Operating Principal
- 11.3 Advantages and limitations

- 11.4 Basic components and their function
- 11.5 Handling and application
- 11.6 General maintenance and repair

**12. Point of care Testing (POCT) Analyzers 4 hour**

- 12.1 Basic concept
- 12.2 Operating Principal
- 12.3 Advantages and limitations
- 12.4 Basic components and their function
- 12.5 Handling and application
- 12.6 General maintenance and repair

**13. Polymerase Chain Reaction 4 hour**

- 13.1 Basic concept and types
- 13.2 Operating Principal
- 13.3 Advantages and limitations
- 13.4 Basic components and their function
- 13.5 Handling and application
- 13.6 General maintenance and repair

**14. Immunochemical Techniques 4 hour**

- 14.1 Basic concept and types
- 14.2 Operating Principal
- 14.3 Advantages and limitations
- 14.4 Basic components and their function
- 14.5 Handling and application
- 14.6 General maintenance and repair

**15. Basic instruments (Centrifuge, Microscope, water bath, incubator, hot air oven glassware, micro pipettes, water purifier, hot plate etc) 4 hour**

- 15.1 Basic concept and types
- 15.2 Operating Principal in applicable instruments
- 15.3 Advantages and limitations
- 15.4 Basic components and their function
- 15.5 Handling and application
- 15.6 General maintenance and repair

**Text and reference books:**

1. Laboratory Quality Management System: handbook, WHO 2011
2. Henry's Clinical Diagnosis and Management by Laboratory Methods, 22nd and above edition
3. IETZ Textbook of Clinical Chemistry and Molecular Diagnostics, Fourth edition above

## PREVENTIVE MEDICINE AND FIRST AID

### SEMESTER VI

#### Course Contents:

#### 1. Man and Medicine

1 hours

History of medicine, Modern medicine, Curative medicine, Preventive medicine, Social medicine

#### 2. Concepts of Health and Disease

2 hours

Biomedical concept, Ecological concept, Definition of health, Dimensions of health, Concept of wellbeing, HPI, Determination of health, Responsibility for health, Indicators of health, Mortality, Morbidity, Concepts of disease, Concepts of causation, Concepts of control, Modes of intervention, Population medicine

#### 3. Principles of Epidemiology and Epidemiological Methods

2 hours

Aims, Approaches, Measurements of morbidity and mortality, Methods, Infectious disease epidemiology, Association and causation, Uses of epidemiology, infection disease epidemiology, Disease transmission, Immunity, Prevention and control, dealing with an epidemic

#### 4. Screening for disease

1 hours

Concepts, Criteria, Sensitivity and Specificity, Problems of the borderline

#### 5. Epidemiology of Communicable Diseases

8 hours

##### a. Respiratory infections

Smallpox, chickenpox, measles, Rubella, Mumps, Influenza, Diphtheria, whooping cough, meningococcal meningitis, Acute respiratory infections, SARS, Influenza, Tuberculosis.

##### b. Intestinal infections

Poliomyelitis, Viral hepatitis, acute diarrheal disease, cholera, typhoid fever, food poisoning, Amoebiasis, Ascariasis, Hookworm infection

##### c. Arthropod-borne infections

Dengue syndrome, Malaria, Lymphatic Filariasis

##### d. Zoonosis

e. Viral

Rabies, Yellow fever, Japanese encephalitis, Chikungunya fever

f. Bacterial

Brucellosis, Leptospirosis, Human salmonellosis

g. Rickettsial Diseases

Rickettsial zoonosis, Scrub typhus, Tick typhus, Q fever

h. Parasitic zoonosis

Taeniasis, Hydatid disease, leishmaniasis

i. Surface infections

Tetanus, Leprosy, STD, AIDS

j. Emerging and re-emerging infectious diseases

k. Hospital acquired infections, Emporiatics

**6. Epidemiology of Chronic Non-Communicable Diseases** **2 hours**

Cardiovascular diseases, Coronary heart disease, Hypertension, Stroke, Rheumatic hearth disease, Cancer, Diabetes, Obesity, Accidents and injuries

**7. Demography and Family Planning** **2 hours**

Demographic trends, Family planning, Contraceptive methods, Post-conceptional methods, Terminal methods, Delivery system

**8. Preventive Medicine in Obstetrics, Pediatrics and Geriatrics** **2 hours**

Mother and child, Antenatal care, Intra natal care, Postnatal care, Care of children, Infancy, Neonatal care, Growth chart, School Health Service, Geriatric prevention of disease

**9. Nutrition and Health** **2 hours**

Classification of food, Dietary goals, Deficiencies, Food hygiene, Foodborne diseases, Food toxicants

**10. Environment and Health** **2 hours**

Water, Acceptability, Microbiological aspects, Chemical aspects, Air pollution, Meterological environment, Excreta disposal, Medical Entomology

**11. Occupational Health** **1 hours**

Occupational hazards, Radiation hazards, Prevention, Legislation

**12. Genetic and Health** **1 hour**

**13. Mental Health** **1hour**

**14. Health programmes in Nepal (Planning and management)** **3 hours**

National vector borne disease control programme

National Anti-malaria programme

National programme for children below 5 years

Vaccination programme

National Programmes of Health and disease eradication /control

A) Health Programmes: - Family Welfare Programme - National Programme for water supply and sanitation. - Nutritional Programmes. - Immunization and universal immunization programme.

B) Disease Eradication programme: Leprosy, Tuberculosis and parasitic infection

C) Disease control programmes: Tuberculosis, Malaria, Filarial, S.T.D, Goitre, Cholera and other diarrheal diseases and National Programme for prevention of blindness including trachoma.

**15. Health information and Basic Medical Statistics** **3 Hours**

Distinction between data and information, Requirement to be satisfied by health information systems, Components of a health information system, Uses of health information, Sources of health information,

- a. Census
- b. Registration of vital events
- c. Sample Registration System
- d. Notification of diseases
- e. Hospital records
- f. Disease registers
- g. Records Linkage
- h. Epidemiology surveillance
- i. Other health service records
- j. Environmental health data
- k. Health manpower statistic
- l. Population survey
- m. Other routine statistics related to health
- n. Non- quantifiable information

**16. Communication for Health Education** **1 Hours**

**17. Health care of the community**

**1 Hours**

**18. International Health**

**1 Hour**

**20. First Aid**

**12 hour**

**What is first AID?**

What is first aider, How to prepare yourself, protection from infection, dealing with casualty, requesting help, the use of medication, remember your own need, Universal precaution.

**Emergency Response**

History of CPR, The ABCs of First Aid, Signs of Heart Attack, Choking, Heimlich Maneuver, Swallowing Foreign Objects, First Aid for Swallowing a Foreign Object, Managing Shock

**Preventive Measures**

Toxins, Fire Safety, Kitchen Safety, Childproofing Your Home

**Managing an incident**

Action at an emergency, traffic accident, electrical incident, water incident, major incident/mass casualty,

**The practice of First Aid**

Making a diagnosis, top to toe survey, removing clothing, Treatment and aftercare.

**The unconscious casualty**

Breathing and circulation, LIFE-SAVING PRIORITIES, unconscious adult, unconscious child, unconscious infant, how to use an AED.

**Disorder of the circulation**

The circulatory system, shock, Fainting, Anaphylactic shock, Disorder of the heart

**Wound and bleeding**

Types of wound, types of bleeding, Severe external bleeding, bleeding at special sites, bleeding from nose

**Bites and stings**

Animal's bites, insect stings, snake bites

**Burns and scalds**

Assessing a burn, severe burns, and scalds, burns to the mouth and throat.

**Poisoning**

What is poisoning, household poison, drug poisoning, industrial poisoning, alcohol poisoning, poisonous plant, Food poison?

**First Aid in the Laboratory**

First aid in chemistry laboratory, Important Terms, Universal precautions, Chemicals in the Eyes, Chemicals in the Mouth, Chemical Spills on the Skin, Fire - Clothing or Hair, Bleeding from a Cut, Breathing Smoke or Chemical Fumes, Fainting, Shock

**Laboratory Safety**

Correct handling of specimens, Correctly dispose of bio hazardous waste., Decontaminate work area daily and as needed, Colored biohazard labels must be placed on all containers used to store, transport or ship blood or body fluids., Fire Safety, **Components of a fire**, Fire extinguishers

**Laboratory Hazard**

Chemical hazard, biological sample hazard, Knowledge about biological weapons, Hazard Warning

**Miscellaneous Condition**

Fever, headache, Toothache, Abdominal pain, Allergy, Hiccups, cramps

**Reference Books:**

1. K. Park: *Park's Textbook of Preventive and Social Medicine* (16<sup>th</sup> Ed.) 2000, M/s BanarsidasBhanot Publishers, Jabalpur.
2. Carolyn Jarvis: *Physical Examination and Health Assessment* (2<sup>nd</sup> Ed.) 1996, W. B. Saunders Company, Philadelphia.
3. Robert H. Gates: *Infectious Disease Secrets*, 1999, Jaypee Brothers Medical Publishers Ltd., New Delhi.



# **TOTAL LABORATORY MANAGEMENT**

## **SEMESTER VII**

### **Course Content**

**32 hour**

#### **1. Introduction to Quality**

- 1.1 Importance of quality in laboratory medicine
- 1.2 Overview the quality management system
- 1.3 The quality management system model
- 1.4 International standards for clinical laboratory
- 1.5 Quality assurance and its components
- 1.6 Quality indicators and their development and utilizations
- 1.7 Challenges in implementation of quality indicators
- 1.8 Accreditation of clinical laboratories

#### **2. Facilities and Safety Management**

- 2.1 Overview
- 2.2 Laboratory design
- 2.3 Physical aspects of premises and rooms
- 2.4 Safety management program
- 2.5 Identification of risks
- 2.6 Personal protective equipments
- 2.7 Emergency management and first aid

#### **3. Equipment Management**

- 3.1 Overview
- 3.2 Selecting and acquiring equipment
- 3.3 Getting equipment ready for service
- 3.4 Implementation of equipment maintenance program
- 3.5 Troubleshooting, service, repair, and retiring equipment
- 3.6 Documentation for equipment management

#### **4. Purchasing and Inventory Management**

- 4.1 Overview
- 4.2 Purchasing
- 4.3 implementation of inventory management program
- 4.4 Quantification
- 4.5 Forms and logs
- 4.6 Receipt and storage of supplies
- 4.7 Inventory monitoring system

#### **5. Process Control-Sample Management and Quality Control**

- 5.1 Overview-Total Testing Process
- 5.2 Laboratory logbook
- 5.3 Collection and preservation
- 5.4 Sample processing
- 5.5 Sample transport, storage, retention and disposal

- 5.6 Overview of quality control
- 5.7 Control materials
- 5.8 Interpreting quality control data

## **6. Assessment-Audit**

- 6.1 Overview
- 6.2 Internal audit
- 6.3 External audit
- 6.4 Action on audit results

## **7. Assessment-External Quality Assessment**

- 7.1 Overview
- 7.2 Proficiency testing
- 7.3 Management of external quality assessment

## **8. Assessment-Norms and Accreditation**

- 8.1 Overview
- 8.2 international standards and standardization bodies
- 8.3 National standards and technical guidelines
- 8.4 Certification and accreditation
- 8.5 Benefits of accreditation

## **9. Personnel**

- 9.1 Overview
- 9.2 Recruitment and orientation
- 9.3 Competency and competency assessment
- 9.4 Training and continuing education
- 9.5 Employee performance appraisal
- 9.6 Personnel records

## **10. Customer Service**

- 10.1 Overview
- 10.2 The laboratory clients-the customers
- 10.3 Assessing and monitoring customer satisfaction

## **11. Occurrence Management**

- 11.1 Overview
- 11.2 Sources and consequences of laboratory error
- 11.3 Investigation of occurrences
- 11.4 Rectifying and managing of occurrences

## **12. Process Improvement**

- 12.1 Continual improvement concept
- 12.2 Tools for process improvement
- 12.3 Quality indicators
- 12.4 Standard operating procedures (SOPs)

- 12.5 Document control
- 12.6 Storing documents and records

### **13. Information Management**

- 13.1 Overview
- 13.2 Elements of information management
- 13.3 Manual paper-based system
- 13.4 Computerized laboratory information system

### **14. Organization**

- 14.1 Organizational requirements for quality management system
- 14.2 Role of management
- 14.3 Organizational structure
- 14.5 Organizational functions: planning and implementation
- 14.5 The laboratory quality manual

#### **Text and reference books:**

1. Laboratory Quality Management System: handbook, WHO 2011
2. Henry's Clinical Diagnosis and Management by Laboratory Methods, 22nd and above edition
3. IETZ Textbook of Clinical Chemistry and Molecular Diagnostics, Fourth edition above

**BIOSTATICS AND RESEARCH METHODOLOGY  
SEMESTER VIII**

**COURSE CONTENT**

**1. Introduction**

**4 hours**

Definition, Scope and limitations, Sources of data, Techniques of collecting primary data, General concepts of sampling

**2. Classification and Presentation of Data**

**5 hours**

Data classification (need, objectives, and types of data collection), Construction of frequency and relative frequency distribution and its principles, Tabular presentation, Diagrammatic presentation (Bar and Pie diagram), Graphic presentation (Histogram, Frequency polygon, Ogive), Stem and leaf display presentation

**3. Fundamental Statistical Measures**

**4 hours**

Measures of central tendency (Mean, Median, Mode, Weighted Average and Geometric mean), Measures of dispersion (Range, Quartile deviation, Standard deviation, Coefficient of variation)

**4. Probability Theory**

**4 hours**

Concept and Importance, Types of events, Objective and subjective probabilities, Marginal and joint probabilities, Theorems of probability, Conditional probability, Mathematical expectation

**5. Distribution**

**5 hours**

Discrete probability distribution (Binomial and poisson distribution and mean of their distributions), Continuous probability distributions, Normal distribution, Normal approximation of Binomial distributions

**6. Test of Significance**

**5 hours**

Test of significance (t-test, Z-test,  $\chi^2$ -test), Computational procedure of hypothesis testing, Hypothesis testing when population S.D. is known, Hypothesis testing when population S.D. is unknown

**7. Simple Correlation and Regression Analysis**

**4 hours**

Scatter diagram, Correlation, Least square regression, Prediction and Confidence intervals for estimating regression parameters

**8. Analysis of variance & covariance**

**2 hour**

Analysis of variance (ANOVA), ANOVA, Basic principle ANOVA, ANOVA technique, Analysis of Co-variance (ANACOVA).

<b>9. Research methodology</b>	<b>4 hour</b>
Introduction & meaning of research, Objectives of research, motivation in research. Types of research & research approaches. Research methods vs. methodology, Criteria for good research	
<b>10. Research problem:</b>	<b>3 hour</b>
Statement of research problem, Statement of purpose and objectives of research problem, Necessity of defining the problem.	
<b>11. Research design</b>	<b>3 hour</b>
Meaning of research design, Need for research design, Features for good design, Different research designs, Basic principles of research design.	
<b>12. Measurement &amp; scaling techniques</b>	<b>3 hour</b>
Measurement in research- Measurement scales, sources of error in measurement, Technique of developing measurement tools, Meaning of scaling, its classification, important scaling techniques.	
<b>13. Methods of data collection</b>	<b>4 hour</b>
Collection of primary data, collection data through questionnaires & schedules, Difference between questionnaires & schedules.	
<b>14. Writing Research Proposal</b>	<b>2 hour</b>
<b>15. Computer technology</b>	<b>6 hour</b>
Introduction to computers, computer application in research computers & researcher, applying computer skills in data entry, processing and analysis: spreadsheet; EPI- INFO and SPSS	
<b>16. Dissemination of results</b>	<b>4 hour</b>
Critique of a research article, writing research article for scientific journals, communication of research findings – short communication notes, rapid communications, participation in Conferences, Congresses and Symposium, presenting reports in Workshops and Seminars	
<b>17. Ethics in Biomedical research</b>	<b>2 hour</b>
<b>18. Referencing system in research</b>	<b>2 hour</b>

**Reference Books:**

1. B. K. Mahajan: *Methods in Biostatistics*. (6<sup>th</sup> Ed.) 1999, Jaypee Brothers, Medical Publishers
2. Jit S. Chandan: *Statistics*. Vikash Publishing House, Pvt. Ltd.
3. C.R. Kothari, *Research methodology (Method & Technique*

4. Kerlinger, F N, Foundations of Behavioral Research, Surjee Publications.
5. IDRC and WHO, Designing and Conducting Health System Research, Volume II, Parts 1 and 2

**GENERAL MEDICINE  
SEMESTER VII**

**Course Content**

**64 hour**

**Respiratory Disorder**

**9 hour**

- Review Structure and function of Respiratory system
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Pneumonia, Acute trachea bronchitis , Atelectasis, Pulmonary tuberculosis, Swine Flu, SARS, chronic obstructive pulmonary disease, Chronic bronchitis, Asthma, Acute respiratory failure, Acute respiratory distress syndrome, Pulmonary hypertension, Pulmonary heart disease (Cor pulmonale), Pulmonary embolism, Respiratory arrest
- Special Diagnostic procedure: Bronchoscopy, arterial Blood gas analysis, Spirometry, Pulmonary Function test, thoracentesis

**Cardiovascular and hematological disorder**

**9 hour**

- Structure and function of cardiovascular and circulatory system
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Acute coronary syndrome: coronary atherosclerosis, angina pectoris, Myocardial infarction  
Inflammatory cardiac disease: Cardiomyopathy, rheumatic endocarditis, infective endocarditis, myocarditis, pericarditis  
Complication from heart disease: Acute pulmonary edema, congestive heart failure, cardiogenic shock, cardiac emergency and arrest  
Vascular disorder: atherosclerosis, hypertension,  
Hematologic disorder: Idiopathic thrombocytopenic purpura, thrombocytopenia, anemia, thalassemia, polycythemia, leukopenia, leukemia, disseminated intravascular coagulation, polycythemia Vera, lymphoma, myeloma
- Special diagnostic procedure; Catheterization and angiography

**Gastrointestinal disorder**

**7 hour**

- Review structure and function of digestive system
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Gastric and duodena disorder; gastritis, peptic ulcer,  
Intestinal and rectal disorder: irritable bowel syndrome, Malabsorption, GI bleeding  
Hepatic disorder: hepatitis (A, B, C, D, E), toxic hepatitis, drug induced hepatitis, hepatic cirrhosis, ascites, hepatic encephalopathy

- Special diagnostic procedure: gastric analysis, gastric acid stimulation test, endoscopy, endoscopic retrograde cholangiopancreatography, breath test, colonoscopy, laparoscopy, liver function test, liver biopsy

### **Urological disorder**

**7 hour**

- Review structure and function of urinary system,
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Fluid and electrolyte imbalance  
Urinary and renal dysfunction  
Infection of urinary tract: pyelonephritis, interstitial nephritis, cystitis, prostatitis, urethritis  
Primary glomerular disease: acute and chronic glomerulonephritis, nephrotic syndrome  
Renal failure: acute and chronic renal failure  
Nephrosclerosis&Hydropnephrosis
- Special procedure: hemodialysis and peritoneal dialysis, renal biopsy

### **Endocrine disorder**

**8 hour**

- Review structure and function of endocrine system
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Pituitary gland disorder: abnormal pituitary function, hypopituitarism, diabetes insipidus, syndrome of inappropriate antidiuretic hormone  
Thyroid dysfunction: abnormalities of thyroid dysfunction, goiter, hypothyroidism, hyperthyroidism, thyroiditis  
Parathyroid dysfunction  
Adrenal gland disorder: Addison's disease, Cushing syndrome, hyperinsulinism, diabetes mellitus: types and complication
- Special diagnostic procedure: RADIOACTIVE Iodine metabolism, serum protein bound iodine, HbA1c, urine test, blood sugar profile, Glycosylated hemoglobin and oral glucose tolerance test thyroid function test

### **Neurological disorder**

**5 hour**

- Review structure and function of nervous system
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Cerebrovascular disease: Stroke  
Intracranial infection: Meningitis, encephalitis  
Degenerative neurologic disorder: multiple sclerosis, Parkinson's disease, Alzheimer disease, Parkinson's disease, seizure disorder  
Cranial nerve disorder: Bell's palsy



Disorder of peripheral nervous system: peripheral neuropathies, Gullian Barr syndrome.  
Myasthenia

- Special diagnostic procedure: Lumbar puncture

### **Skin disorder**

**3 hour**

- Review anatomy and physiology of skin
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Pruritus, secretary disorder, bacterial, fungal, viral and parasitic skin infection, contact dermatitis, common blistering disease, leprosy

### **Musculoskeletal disorder**

**3 hour**

- Review structure and function of musculoskeletal system
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Paralyzed intervertebral disc, carpal tendon syndrome, blisters, cors, osteoporosis, Paget's disease, gout, arthritis. Strains. Fracture

### **Eye disorder**

**3 hour**

- Review structure and function of eye
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Errors of refraction, Conjunctivitis, keratitis, corneal ulcer, episcleritis, uveitis, cataract, glaucoma, retinitis, retinoblastoma, dry eye, watering eye, dacryocystitis, proptosis, night blindness

### **Ear disorder**

**3 hour**

- Review structure of ear and physiology of hearing
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Hearing impairment, inflammatory condition of pinna, acute otitis media, chronic otitis media, otitis media with effusion, vertigo, acoustic neuroma

### **Nose and throat disorder**

**3 hour**

- Review anatomy and physiology of nose and throat
- Etiology, Pathophysiology, clinical manifestation and diagnostic measure of following condition  
Acute and chronic rhinitis, nasal polyps, epistaxis, sinusitis, stomatitis, tonsillitis,

**Oncology****4 hour**

- Definition and epidemiology
- Pathophysiology of malignant process\ detection and prevention of cancer: Warning sign of cancer, primary prevention, secondary prevention
- Diagnosis of cancer
- Modalities of cancer management
- Surgery, radiation therapy, chemotherapy, bone marrow transplantation.

***Annex I***

## Bachelor of Science in Laboratory Medicine

### Evaluation Scheme

#### General Guidelines

Question patterns in University examination

- Objective Question - Multiple Choice Question (MCQ)
- Subjective Question - Short answer question and subject specific problem based question or clinical / Case based question

#### Two categories of Subject

- 100 marks subject (For which university exam will be of 80 marks)
- 50 marks subject (for which university exam will be of 40 marks)

**Table: Pattern of Question**

S.N	Question pattern	80 mark subject		40 mark subject	
1	Multiple choice question	20 Q X 1 mark each	20	10 Q X 1 mark each	10
2	Short answer question	6 Q X 5 mark each	30	4 Q X 5 mark each	20
3	Subject specific problem based question (SS- PBQ) OR Clinical/Case	3 Q X 10 mark each	30	1 Q X 10 mark each	10
	Total		80		40

Note:

University Examination will be conducted by the Far-western University  
 Internal mark: Internal mark will be sent based on class test, assignment, presentation, viva-voce and internal examination

### Categories of the subjects/papers

		Code	University Examination	Internal Examination	Total marks
<b>SEMESTER I</b>	<b>Theory</b>		<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	Anatomy I		70	30	100
	Biochemistry I		70	30	100
	Microbiology I		70	30	100
	Pathology I		70	30	100
	Pharmacology I		70	30	100
	Physiology I		70	30	100

			University Examination	Internal Examination	Total marks
<b>SEMESTER II</b>	<b>Theory</b>	Code	<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	Anatomy II		70	30	100
	Biochemistry II		70	30	100
	Microbiology II		70	30	100
	Pathology II		70	30	100
	Pharmacology II		70	30	100
	Physiology II		80	30	100
	<b>Practical</b>		<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	<b>Laboratory I and II</b>				
	Anatomy		40	10	50
Physiology		40	10	50	
Biochemistry		40	10	50	
Microbiology		40	10	50	
Pharmacology		40	10	50	
Pathology		40	10	50	

			<b>University Examination</b>	<b>Internal Examination</b>	<b>Total marks</b>
<b>SEMESTER III</b>	<b>Theory</b>	<b>Code</b>	<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	Anatomy III		70	30	100
	Biochemistry III		70	30	100
	Microbiology III		70	30	100
	Pathology III		70	30	100
	Pharmacology III		70	30	100
	Physiology III		70	30	100
	Introduction to Clinical Laboratory		70	30	100

			<b>University Examination</b>	<b>Internal Examination</b>	<b>Total marks</b>
<b>SEMESTER IV</b>	<b>Theory</b>	<b>Code</b>	<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	Anatomy IV		70	30	100
	Biochemistry IV		70	30	100
	Microbiology IV		70	30	100
	Pathology IV		70	30	100
	Pharmacology		70	30	100
	Physiology IV		70	30	100
	<b>Practical</b>		<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	<b>Laboratory III and IV</b>				
	Anatomy		40	10	50
Physiology		40	10	50	
Biochemistry		40	10	50	
Microbiology		40	10	50	
Pharmacology		40	10	50	
Pathology		40	10	50	

			<b>University Examination</b>	<b>Internal Examination</b>	<b>Total marks</b>
<b>SEMESTER V</b>	<b>Theory</b>	<b>Code</b>	<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	Clinical Biochemistry I		70	30	100
	Clinical Microbiology I (Bacteriology)		70	30	100
	Hematology I		70	30	100
	Histology & Cytology I		70	30	100
	Preventive Medicine & First Aid		70	30	100

			<b>University Examination</b>	<b>Internal Examination</b>	<b>Total marks</b>
<b>SEMESTER VI</b>	<b>Theory</b>	<b>Code</b>	<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	Clinical Biochemistry II		70	30	100
	Clinical Microbiology II (Virology, Parasitology & Mycology)		70	30	100
	Forensic Medicine & Toxicology		70	30	100
	Hematology II		70	30	100
	Histology & Cytology II		40	10	50
	<b>Practical/Clinical</b>		<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	Clinical Biochemistry Laboratory I & II		70	30	100
	Clinical Microbiology Laboratory I & II		70	30	100
	Hematology Laboratory I & II		70	30	100
	Histology & Cytology Laboratory I & II		70	30	100

			<b>University Examination</b>	<b>Internal Examination</b>	<b>Total marks</b>
<b>SEMESTER VII</b>	<b>Theory</b>	<b>Code</b>	<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	Analytical technique & Automation		70	30	100
	Clinical Microbiology III (Immunology)		70	30	100
	Human Genetics & Molecular Biology		70	30	100
	General Medicine		70	30	100
	Total Laboratory Management		70	30	100
	Transfusion Medicine & Blood Banking		70	30	100

			<b>University Examination</b>	<b>Internal Examination</b>	<b>Total marks</b>
<b>SEMESTER VIII</b>	<b>Theory</b>	<b>Code</b>			
	Biostatistics and Research Methodology		70	30	100
	<b>Practical/Clinical</b>		<b>Max Marks</b>	<b>Max Marks</b>	<b>Max Marks</b>
	Project Work Proposal				100
	• Writing		-	30	
	• Presentation		-	20	
	Final Project				
• Report writing		-	30		
• Presentation/Viva		-	20		
Clinical Laboratory Practicum (CLM)					
1. Clinical Biochemistry			80	20	100
2. Clinical Microbiology			80	20	100
3. Clinical Hematology & Blood Banking			80	20	100
4. Histology & Cytology			80	20	100